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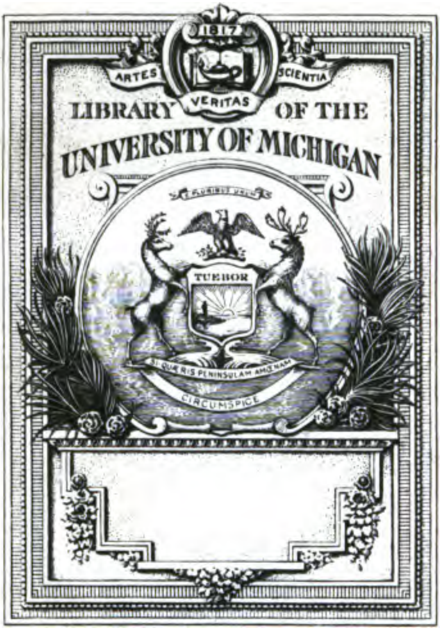
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PHILOSOPHY IN SPORT.

VOL. III.

'Tis not enough that Greek and Roman page,
At stated hours, the sprightly boy engage;
Ev'n in his pastimes he requires a friend,
To warn, and teach him safely to unbend;
And levying thus, and with an easy sway,
A tax of profit from his very play,
T' impress a value, not to be eras'd,
On moments, squander'd else, and running all to waste.

Cowper's *Tirocinium.*

London:
Printed by A. & R. Spottiswoode,
New-Street-Square.

Paris, John Ayrton

PHILOSOPHY IN SPORT

MADE

SCIENCE IN EARNEST;

BEING

AN ATTEMPT TO ILLUSTRATE THE FIRST PRINCIPLES
OF NATURAL PHILOSOPHY

BY THE AID OF

POPULAR TOYS AND SPORTS.

IN THREE VOLUMES.

VOL. III.

LONDON:
PRINTED FOR
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" All things *by turns.*"

CHAPTER I.

A COMMUNICATION WHICH THREW ALL OVERTON INTO A BUSTLE. — THE THAUMATROPE. — THE AMUSEMENT WHICH ITS EXHIBITION AFFORDED. MRS. SEYMOUR IMPROVES ITS CONSTRUCTION, AND RENDERS IT LITTLE LESS THAN AN INSTRUMENT OF MAGIC.

IT had been previously determined that the happy pair should visit London, on their return from Yorkshire to Overton, and spend a few days at Holding's Hotel, in order that they might execute the various commissions with which their worthy uncle had charged them. Three weeks having elapsed since the marriage, the major had become impatient to hear of their arrival in Dover Street, when information was received that a waggon laden with stores had just reached Osterley Park. The next post brought a letter from Harry Beacham, in which he enumerated the purchases he had made in London, and informed his uncle that he intended to bring his bride to the Park on that day week, and he calculated upon reaching Overton by four o'clock. He begged the major to present Mr. Seymour with a little box, which he would receive from the hands of the carrier: it contained, he said, a very amusing and philosophical toy *, which had lately made its appearance in the scientific circles of London, and knowing how much his friend at the lodge prized such inventions, for the instruction of his children, he had forwarded it without delay.

" So then," exclaimed the major, " a week only remains for the completion of all my preparations for the fête; let the information be immediately communicated to the workmen at the Park; let the vicar also be instantly apprised of this communication; the notable hostess of

---

* We have since learned that Mr. Beacham obtained this toy at Mr. William Phillips's, George Yard, Lombard Street, the publisher. We mention this circumstance to guard the reader against those inferior imitations which are vended in the shops of London.

the village inn must likewise be warned to prepare for the merry-making, and to furnish the necessary accommodations for those numerous visitors which the approaching fête will bring to Overton. The tenants of my estate must also be instructed to make arrangements for receiving the bride in a style suitable to the joy of the occasion." These, and sundry other directions, did the worthy major issue forth, on the receipt of the above-mentioned letter.

Such was the position of affairs which marks the commencement of the third volume of our history. Tom had arrived from school; and Mr. Seymour was frequently engaged in pursuing those philosophical instructions, which we have described in the preceding volumes. The new toy had been received from the major; but no sooner did Mrs. Seymour see it than she begged it might not be exhibited until she should have effected an improvement in its construction, of which she at once perceived it to be capable. This improvement had, in the course of a couple of days, been very successfully completed, and we shall, therefore, now relate the nature of the toy, and the amusing conversation which accompanied its introduction.

The vicar had been closeted with the major for several hours, for the purpose of consulting the Chronicles of Holinshed and Froissart, touching certain points of ceremonial on which they had been at issue; and especially that which distinguished the public entrance of Queen Isabella into the good city of Paris, on which occasion there was a pageant, representing the siege of Troy. On quitting the library, they were met by Mr. and Mrs. Seymour, the former of whom expressed a wish that they should proceed to the drawing-room, in order to see the new toy which Mr. Beacham had sent them; and which, he said, unless he were greatly mistaken, would afford as much amusement to the elder as to the younger members of the party, though he thought it probable that the vicar might regard it as a more hostile instrument than even that of the wooden horse, which filled unhappy Troy with an armed enemy.

"It is a small machine," continued Mr. Seymour, "which is calculated to deluge us with puns."

"With puns!" exclaimed the horrified vicar, who no sooner heard this declaration, than, like another Laocoon, he deprecated the introduction of the "*donum exitiale*" within the walls of Overton Lodge. But his hostility was soon disarmed, not by the circumvolutions of a snake around the body of the enraged orator, but by the embraces of little Rosa, who threw her arms around the neck of the vicar, with such supplicating grace, that at length he exclaimed, "Well, well; if it be the decree of the fates, I must submit."

During this altercation, Mr. Seymour had procured the "wooden engine" from his study.

"I will first," said he, "exhibit the toy in its original state, and then show you the improvements which have been effected in it by Mrs. Seymour."

"Let us hear the account of its operation," said the major, "which I perceive is enclosed within the box."

"True," replied Mr. Seymour; "and its inventor has given a very plausible explanation of its effects."

"Plausible," muttered the vicar, "plausible enough, no doubt; oh the Sinon!"

Mr. Seymour then proceeded. "This toy is termed the THAUMATROPE."

"Of Grecian origin!" observed the vicar. "'*Timeo Danaos et dona ferentes*,' as Virgil has it."

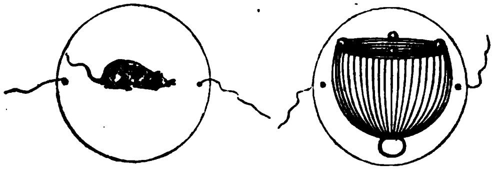
"What is the meaning of the term?" asked Louisa. The vicar explained to her that it was compounded of the Greek words, θαυμα, and τρεπω; the former of which signified *wonder*, the latter, *to turn*."

"Exactly," replied Mr. Seymour, "'*A Wonder-turner*,' or a toy which performs wonders by turning round; but let me proceed in the explanation." He then continued to read as follows: "This philosophical toy is founded upon the well-known optical principle, that an impression, made on the retina of the eye, lasts for a short interval, after the object which produced it has been withdrawn. During the rapid whirling of the card, the figures on each of its sides are presented with such quick transition that they both appear at the same instant, and thus occasion a very striking and magical effect. On each of these cards a device is introduced, with an appropriate motto, or epigram; the point of which is answered, or explained, by the change which the figure assumes during the rapid whirling of the card."

“It may be very clever,” said the vicar, “but I do not understand it.”

“But you shortly will; look at one of the cards.”

Mr. Seymour then displayed a pasteboard circle, on the one side of which was figured a rat, and on the other, a cage; two strings were fastened in its axis, by which the card could easily be made to revolve, by means of the thumb and finger. Fearing that some of our readers may be as dull of comprehension as the vicar, we have introduced a sketch of the apparatus, in which both sides of the card are exhibited, with the strings by which it is whirled round.



No sooner had Mr. Seymour put the card in motion than the vicar, in a tone of the greatest surprise, exclaimed, “Magic! magic! I declare the rat is in the cage!!”

“And what is the motto?” asked Louisa.

“Why is this rat like an opposition member in the House of Commons, who joins the ministry?" replied Mr. Seymour.

"Ha, ha, ha, — excellent," cried the major, as he read the following answer: "because by *turning round* he gains a snug birth, but ceases to be free."

"The very reverse to what occurred in ancient Rome, where the slave became free, by turning round," observed the vicar.

The vicar, no doubt, alluded to the custom of making a freeman, as described by Persius; from which it appears, that the clapping a cap on the head, and giving him a turn on the heel, were necessary circumstances. A slave thus qualified became a citizen of Rome, and was honoured with a name more than belonged to any of his forefathers, which Persius has repeated with a great deal of humour in his 5th satire: —

"—— Heu steriles veri, quibus una Quiritem
Vertigo facit!"

"That false enfranchisement with ease is found;
Slaves are made citizens by turning round."
DRYDEN.

"Show us another card," said Tom, eagerly.

"Here then is a watch-box; when I turn it round, you will see the watchman comfortably sleeping at his post."

"Very good! It is very surprising," observed the vicar.

"Yes," observed the major; "and to carry on your political joke, it may be said that, like most worthies who gain a post, by *turning round*, he sleeps over his duty."

"The epigram which accompanies it is not deficient in point," said Mr. Seymour.

"The caprice of this watchman surpasses all bounds;
He ne'er sits in his box, but when going his *rounds:*
While he no sooner rests, 'tis a strange paradox!
Than he flies from his post, and *turns* out of his box."

"What have you there?" exclaimed the vicar; "arms and legs, without any body?"

"Yes," replied Mr. Seymour; "and which, on turning round, will present the figure of a king, invested with all the insignia of royalty."

"It is indeed a king. Look at his crown and sceptre!" cried Louisa.

"Now for the epigram," said the major, who then read the following lines:—

"Head, legs, and arms, alone appear;
Observe that no*body* is here:
Napoleon-like I undertake
Of nobody a king to make."

The other cards were now exhibited in succession, of which the box contained eighteen, and the whole party, not even excepting the vicar, were highly gratified with the amusement.

"But I have not yet read to you the author's address to the public; and which, I must say, contains a succession of very happy puns."

"Spare me! spare me!" cried the vicar: "I like your toy, but cannot discover the advantage of alloying amusement with such spurious wit, and of associating science with buffoonery."

Mr. Seymour, however, was relentless, and thus proceeded: "It is well known that the Laputan philosopher invented a piece of machinery, by which works could be composed by a mechanical operation; and the Quarterly Review has asserted, that a certain English poem was fabricated in Paris, by the powers of a steam-engine; but the author of the present invention claims for himself the exclusive merit of having first constructed a hand-mill, by which puns and epigrams may be *turned* with as much ease as tunes are played on the hand-organ, and old jokes so *rounded* and changed, as to assume all the airs of originality. The inventor confidently anticipates the favour and patronage of an enlightened and liberal public, on the well-grounded assurance, that '*one good turn* deserves another;' and he trusts that his discovery may afford the happy means of giving activity to wit that has been long *stationary*; of *revolutionising* the present system of *standing* jokes, and of putting into *rapid circulation* the most approved bon mots."

"Why, vicar, what ails thee?" exclaimed the major.

"Our subject has given him a *turn*; let him alone, and he will soon *come round*," observed Mr. Seymour.

The whole party, with the exception of Mr. Twaddleton, burst into a roar of laughter; the vicar, however, did not relax a feature of his countenance.

As soon as this ebullition had subsided, the major enquired of Mrs. Seymour, what was the nature of the improvement she had contemplated.

"My proposed improvements refer both to the subjects, exhibited on the cards, and to the mechanism by which their changes are effected," replied Mrs. Seymour.

"In the first place, it has occurred to me that this amusing toy might be made instrumental in impressing classical subjects upon the memory of young persons."

This observation delighted the vicar, who said that he would patronise such an attempt with all his heart.

"Why can we not," continued the lady, "thus represent the Metamorphoses of Ovid; or what say you, vicar, to converting the fleet of Æneas into sea-nymphs, as Virgil has it?"

"An elegant thought! upon my word, madam; a most elegant conception!" exclaimed Mr. Twaddleton.

"What have we here?" interrupted the major, who had, for the first time, noticed the superscription on the cover of the box: "had I seen this before, I should have augured favourably of the toy: it is like the sign of an inn, which is held out to announce good entertainment within." He then read the following: —

The Thaumatrope;
being
Rounds of Amusement,
or
How to please and surprise
By Turns.

Mrs. Seymour now quitted the room in order to prepare for the exhibition of her improved thaumatrope.

During her absence, Mr. Seymour proceeded to explain more fully the optical theory of the instrument, which neither Louisa nor Tom could, as yet, thoroughly understand.

He told them that an object was seen by the eye, in consequence of its image being delineated on the retina, or optic nerve, which is situated on the back part of the eye; and that it had been ascertained, by experiment, that the impression which the mind thus receives, lasts for about the eighth part of a second, after the image is removed. "It is, therefore, sufficiently evident," said Mr. Seymour, "that if any point, as a lighted stick, be made to revolve, so as to complete the circle in that period, we shall not see a fiery point, but a fiery circle; because the impression made by it in every point of its circuit will remain until it comes round again to the spot from which it set out; — but we will, at once, exemplify this fact by an experiment."

Tom was accordingly directed to procure a piece of stick and a candle; and as soon as they were brought into the room, Mr. Seymour ignited the end of the stick, and whirled it round, when a bright circle, without any intervals of darkness, was seen by the whole party.

"Never until this instant," exclaimed the vicar, with an expression of high satisfaction, "did I fully appreciate the beauty of that passage in Milton, wherein the poet evidently describes the rapidity of Satan's flight, as well as the refulgence of his appearance —

> " 'Sprung upward like a pyramid of fire.'

"Now to take in the full meaning of this figure," continued Mr. Twaddleton, "we must imagine ourselves in chaos, and that a vast luminous body is rising near the spot where we may be supposed to be standing, so swiftly as to appear a continued track of light, and lessening to the view, according to the increase of distance, until it ends in a point, and then disappears; and all this must be supposed to strike our eye at one instant."

"It is very probable," said Mr. Seymour, "that the poet had such an idea in view, and that he intended by it to convey the immense rapidity of Satan's flight. Homer makes use of the same figure to express the velocity of the javelin, δολιχοσϰιον εγχος, the '*long shadowed*' javelin. We shall have ample proof of the effect of this power in the eye of retaining impressions, and of thus converting points into lines and circles, during the exhibition of your fireworks; and which, in fact, derive the greater part of their magical effect from it."

"The pin wheel is certainly nothing more than a fiery circle produced by the rapid revolution of a jet of flame," said the vicar.

"And the rocket," added Mr. Seymour, "is a column of light occasioned by the same rapid movement of a burning body in a rectilinear or curved direction."

"I perfectly understand all that you have said," observed Tom.

"Then you will not have any difficulty in explaining the action of the Thaumatrope, for it depends upon the same optical principle; the impression made on the retina by the image, which is delineated on one side of the card, is not erased before that which is painted on the opposite side is presented to the eye; and the consequence is, that you see both sides at once."

"Or, you might put it in this way," said the major: "that as the image remains the eighth of a second on the retina, after it has been withdrawn from the eye, a revolution of eight times in a second will secure its uninterrupted continuance."

"On turning round the card," observed Louisa, "I perceive that every part of the figure is not equally distinct."

"Because every part of the card does not revolve with the same velocity," said her father; "and this fact offers a good illustration of what I formerly stated*, that in circular motion, the parts more remote from the axis of rotation are those which move with the greater velocity. This toy will also be found capable of exemplifying another truth to which I have before alluded, that 'the axis of motion remains at rest while all the parts revolve round it.'" †

"I remember that very well," exclaimed Tom.

"Then take the card, and spin it between yourself and the window, and tell me what you observe," said his father.

"I see a dark line across the window; and what is very strange, the other parts of the card appear transparent, for they do not obstruct the view of the window, as they would if the card were at rest."

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* Vol. I. p. 275.

† Ibid. p. 100.

"The dark line you see is the axis of rotation, which being stationary, necessarily excludes the light; the other parts being in motion do not remain a sufficient time to obliterate the image made on the eye by the window. It is true that the card disc passes between your eye and the light, but as it does not continue at any one point for more than the eighth of a second, there is no more apparent intermission of the light than what occurs during the winking of the eyes."

"You allude to a very curious fact," observed the vicar, "that, although we are perpetually covering the eye-balls with our eyelids, we are not conscious of the intervals of darkness."

"The reason of which must surely be obvious from the explanation I have just offered," said Mr. Seymour: "the sensation of light is not exchanged for that of darkness in so short a period as the twinkling of the eye."

"I admit the plausibility of your theory," said the vicar; "but it appears to me that objects frequently linger on the sight for a longer period than that which you assign to them. I well remember seeing the flame of a candle for several seconds after it had been suddenly withdrawn from the apartment."

"I admit that strong lights frequently continue for some time thus visible in the 'mind's eye;' and it is well known that such impressions are often followed by images of similar shape, but of various colours. In passing from sunshine to a dark room, we frequently witness the appearance of stars and circles of vari-coloured light; but this phenomenon is very distinct from that of the Thaumatrope, and is to be explained upon very different principles."*

"I know exactly to what you allude," said the major; "and I do not doubt but that many of those illusive appearances, which have been described, might be referred to the operation of the same natural cause. It is easy to imagine that a person who has steadfastly fixed his eyes upon an illuminated object, may, for some minutes afterwards, see the same figure in shade; it was from such a cause, no doubt, that Constantine saw the image of a cross in the sky. You are, probably, acquainted with the opinions of Eusebius, Fabricius, and Dr. Lardner, upon this alleged miracle."

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* Those who are desirous of gaining farther information upon this subject may consult the chapter on "Ocular Spectra," in Dr. Darwin's Zoonomia.

"I admire the ingenuity of your theory," said the vicar, "and am not prepared to question its truth. But see, here comes Mrs. Seymour."

"If I shall not interrupt your discussions," said the lady, "I will now exhibit my proposed improvements."

"Believe me, madam, we are all impatient to witness your classical suggestions," replied the vicar.

"Behold, then, the Trojan ships!"

"Ay, ay, sure enough; but let me see, are their forms according to ancient authority? Very well, indeed, Mrs. Seymour. Very well; the poops have the bend so accurately described by Ovid and Virgil—'*Puppesque recurvæ,*' as the poet has it. And there is the triton; but is its size in proportion to the vessel? Yes, madam, you are doubtless correct, the figure is generally represented of considerable magnitude on ancient medals; and *Silius Italicus,* if my memory serves me, alludes to the weight of the image having on some occasions contributed to the wreck of the vessel."

"Spin them round," said Mrs. Seymour.

The vicar complied; exclaiming at the same moment, "'*Vos ite solutæ. Ite deæ pelagi.*' They are positively converted into sea-nymphs. '*mirabile monstrum!*'" cried Mr. Twaddleton.

"Here is another classical device; the representation of Eurydice, as she fell lifeless at the moment Orpheus turned round to gaze on her," said Mrs. Seymour.

"Charming! charming! I perceive that it is a copy from the splendid print of Didot in the Paris edition of Virgil."

"Turn it round, vicar."

"See! see! she revives, she opens her eyes, and throws her arms around the neck of her frantic lover: truly, Mrs. Seymour, this is a most interesting toy," said Mr. Twaddleton.

Mr. Seymour here observed that he had written an epigram to accompany the subject they had just witnessed, and he trusted that he had given to it a classical *turn*.

"By all means read it; the subject admits of much classical decoration," observed the vicar.

Louisa received the epigram from the hands of her father, and read as follows:

"By *turning round*, 'tis said, that Orpheus lost his wife;
Let him *turn round* again, and she'll *return* to life."

It could not be expected that Mr. Twaddleton should have admired lines so burdened with puns; but he quietly observed, "I should have preferred a quotation from the fourth Georgic, so beautifully descriptive of the fable."

The next card that was presented for inspection exhibited the metamorphosis of Daphne into a laurel. As the figure revolved, the leaves were seen sprouting from her fingers, and her arms lengthening into branches.

"Come now," said Mr. Seymour, "let us exhibit the figure which has been designed at my request: the change which it will undergo during its revolution may, I trust, on some day be realised; I only regret that it is not in my power to give the vicar so good a *turn*.

"Really, if like Crambe, in Martinus Scriblerus, thou hadst a word for every day in the year, I should certainly say that you were this day under the dominion of the word *turn*."

"You know this resemblance?" said Mr.

Seymour, as he showed the figure, painted on one side of the card, to his daughter.

" It is the vicar ! " exclaimed Louisa.

It was, indeed, a portrait of that most excellent character, represented in the costume in which he usually appeared.

" Turn it round," said Mrs. Seymour.

" Louisa twirled the cord, and the whole party burst into a paroxysm of laughter; for the effect of the rotation was to convert the humble vicar into the dignified bishop; his meagre form was instantly changed into a corpulent figure, which was still farther inflated by the addition of the episcopal robe and lawn sleeves, while his angular features were softened by the graceful curves of an immense wig.

" I will give you a motto for it," said the major, " and may it be prophetic! — RAPID PREFERMENT."

" Now," said Mrs. Seymour, " I will show you the improvement which I have made in the construction and use of this toy. It consists in altering the axis of rotation while the card revolves, and thus brings the images on the opposite sides in different positions with respect to each other."

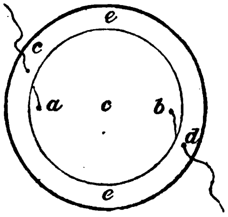
"There cannot be any doubt that such would be the effect, if it were possible to change the axis in the way you propose; but how is this to be effected?" said the vicar.

"At first I attempted to effect the change by the addition of other strings; but I soon found that, in order to avail myself of this expedient, I should be obliged to stop the card before I could change its axis, whereas my object was to produce the alteration while the card was in the act of spinning."

"And that, I fear, must be the case, whatever expedient you may adopt," observed Mr. Twaddleton.

"No, indeed; I have surmounted the difficulty by a very simple process."

Mrs. Seymour then exhibited her contrivance, which we shall endeavour to explain by the assistance of the annexed diagram.



e e is a frame-work of card, in which the disc *a c b* is made to traverse freely; the position of its two strings is seen at *a b*, which having been fastened, at those points, to the central card, are carried through openings in the frame-work at *c d*. As the card revolves, the strings are pulled with a certain degree of force which causes it to change its position, until the point *a* shall coincide with *c*, and *b* with *d*. Mrs. Seymour having explained the construction of her apparatus, proceeded to display the effects of its action.

"Here," said she, "you perceive a horse; on turning it round you will observe a jockey seated on its back."

While the party were steadfastly observing the change thus produced, the exhibiter tightened the strings, the card changed its position, and the jockey was, in an instant, canted over the head of his charger, to the no small delight of the children, and to the utter amazement of the vicar and major, who simultaneously declared it to be one of the most magical effects they had ever witnessed. Several other subjects were then submitted to a similar operation;

we shall select a few of the more striking ones for the amusement of the reader.

The figure of an Indian juggler was represented in the act of throwing up *two* balls; on spinning the card, and, at the same time, altering the position of the circle, in the manner already described, *three*, and afterwards *four*, became visible. When the card revolved upon its original axis, two of the balls on the reverse side coincided with the two painted on the front, so that during the revolution they fell upon the same spot on the retina, and therefore produced a single impression; but as soon as the position of the card was changed, these spots were brought upon different points, and consequently produced separate and independent images.

The next subject which we shall describe produced a considerable degree of merriment. The vicar inspected the drawing, and observed that he saw a pulpit placed on the banks of a pond; the card was made to spin, when a tailor was seen haranguing from the former, and a goose, at the same instant, fluttering over the water. The circle was now suddenly shifted, and the vicar was desired to state what he saw: — "Why, bless me!" exclaimed Mr. Twaddleton, "the tailor is justly served, he is ducked in the pond, while the goose has taken his place in the pulpit."

Fearing that we may have exhausted the patience of our reader, we shall only relate one more example. It was a Turk, who, by means of the expedient we are illustrating, was made to draw his sabre, and cut off the head of his antagonist, which immediately fell into the hands of the decapitated person, who, like St. Denys, appeared as if walking off with perfect indifference.

"You must admit," said Mrs. Seymour, "that these optical effects are no less novel than they are extraordinary; and I have still an expedient for extending them. It is my intention to connect the movable circle, by means of a spring, with the frame, so that when I shall have changed its position by pulling the strings, the card may be enabled to recover its original position. I shall thus be capable of producing a see-saw motion, which will greatly heighten the effects of certain subjects. In this manner a sailor may be made to row a boat, a dandy to make a bow," &c.

"Madam," said the vicar, "you have already exhibited such proofs of talent, that I can readily believe you capable of accomplishing the design you propose; but I hope that, amidst all your improvements, you will still keep in view your first and most laudable design, that of rendering it subservient to classical illustration.

CHAP. II.

THE VICAR'S SERMON.—THE EMIGRATION OF MISS RYLAND AND HER CRONIES.—VILLAGE PREPARATIONS FOR THE RECEPTION OF MR. BEACHAM AND HIS BRIDE.—THE PROCESSION.—MR. TWADDLETON ADDRESSES THE ASSEMBLY.—THE MAJOR AND HIS VISITORS ARE ACCOMPANIED BY MR. SEYMOUR AND THE VICAR, TO SUPERINTEND THE ARRANGEMENTS FOR THE ENSUING FESTIVITIES.—THE CURIOUS DISCUSSIONS WHICH TOOK PLACE ON THAT OCCASION.—THE ORIGIN OF THE SWING.—MERRY-ANDREWS.—TRAGETOURS.—OTHER ITINERANT SONS OF COMUS.—THE DINNER AT THE HALL.—THE LEARNED CONTROVERSY WHICH WAS MAINTAINED WITH RESPECT TO THE ORIGIN OF CHESS, AND SOME OTHER GAMES.

THE reader will remember that Will Snaffle the village saddler, and Sam Tickle the watchmaker, had been arrested for debts, contracted in the pursuit of their visionary schemes, and thrown into gaol. To the delight and great astonishment, however, of themselves and friends, their incarceration was but of short duration. They had been released through the interposition of some kind but unknown friend; for the hand thus generously stretched out in the hour of need had been concealed with studied caution. Acquainted as we are with the character of Mr. Twaddleton, we have little doubt but that, through his kindness, this arrangement had been accomplished; and our opinion was greatly strengthened upon hearing the sermon which he delivered on the Sunday after their liberation. His text was taken from the 38th chapter of Ecclesiasticus, verses 24, 25, &c.; and so exactly did it express the vicar's sentiments on the subject of scientific education, that we cannot resist the satisfaction of quoting it:— "*The wisdom of a learned man cometh by opportunity of leisure; and he that hath little business shall become wise. How can he get wisdom that holdeth the plough, and that glorieth in the goad, that driveth oxen, and is occupied in their labours, and whose talk is of bullocks?—So every carpenter, and workmaster, that laboureth night and day* * * * *All these trust to their hands, and every one is wise in his work. Without these cannot a city be inhabited; and they shall not dwell where they will, nor go up and down. They shall not be sought for in public counsel, nor sit high in the congregation; they shall not sit on the judge's* *seat, nor understand the sentence of judgment;—and they shall not be found where parables are spoken. But they will maintain the state of the world, and their desire is in the work of their craft.*"

Upon this text did the vicar comment with great temperance, but in a firm and decisive tone; pointing out the rashness of those who, bred to useful and laborious callings, attempt, without the necessary qualifications, to follow the higher pursuits of intellect. He, however, with the true spirit of a Christian pastor, observed, that we were but men, full of frailty and prone to err, and it was our duty to reclaim, rather than to rebuke, those who had heedlessly wandered from the high road.

Some other hints fell from the reverend gentleman, which fully satisfied us that he had been the means of restoring the unfortunate speculators to the stations from which their imprudence had driven them.

We have yet another event to record, before we conduct the reader to the fête, which is to terminate our history; and as we would dismiss him with feelings of unalloyed hilarity, we have chosen the present occasion for relating a circumstance which must necessarily excite a certain degree of regret — the fate of Miss Ryland and her maiden companions. These ladies, after due enquiry, found that the events stated in Mr. Timothy Crakenhorn's letter were too true; they were indeed reduced, if not to actual penury, to so low a state of finance, as to render their residence in Overton no longer prudent, unless they submitted to privations which they could better bear where they were less known. They accordingly quitted the village, and have never since been heard of; although it is generally supposed that they sought an asylum in some obscure part of France, where all the necessaries of life are to be obtained on a very small scale of expenditure.

It will be remembered that Henry Beacham had announced his intention of arriving at Overton, with his lovely bride, by four o'clock. No sooner did this intelligence become public than the more respectable yeomen of the parish, at the desire of Mr. Seymour and Major Snapwell, assembled at the village inn, to concert a plan for receiving them with all due honour. The vicar was respectfully consulted on this occasion; and at his suggestion it was finally arranged, that the village should be decorated with garlands, and the May-pole erected on the spot, where its gaudy streamers had for so many ages annually floated on the breeze of spring; for, as the reverend gentleman very justly observed, the blooming pride of May and of youthful beauty was one and the same, and should therefore be typified by kindred emblems. It was, moreover, determined that every tenant, who could furnish himself with a horse, should attend at a certain spot by the hour of three, in order to advance in procession to meet the happy couple, and escort them through Overton to Osterley Park. In furtherance of this plan, the major signified his desire that those musicians, who had lately arrived for the impending festivities, should be in attendance at the appointed place and hour.

Every arrangement at Osterley Park had been completed on the day preceding that on which the return of the newly married pair were expected. The various show-booths had, under the superintendence of Ned Hopkins, been erected by their respective owners with an expedition that might have put many a prouder architect to shame: the marquees and temporary rooms for refreshments had been completed under the management of Tom Plank; and for those, whose appetite might hold precedence of the senses of sight and hearing, ample funds of gratification had been provided by the accomplished hostess of the "Bag-of-Nails," whose grim troop of pots and kettles had, during the whole of the preceding week, in anticipation of the approaching feast, been chirping and chuckling over the kitchen-range, which had been doomed to such incessant labour, that its very cheeks had cracked from yawning. The erection of a convenient stage for the display of fire-works had been accomplished under the sole guidance of Major Snapwell, who considered this department as belonging more immediately to himself. The preparations for the *naumachia*, or sham naval fight, were entrusted to Will Snaffle, whose profound skill in naval tactics cannot be unknown to the reader.

The friends of Major Snapwell had already arrived at the Park; and Overton Lodge was overflowing with visitors. The major had provided four carriages, besides a number of horses, for the accommodation of his guests; and

Mr. Seymour had directed sundry vehicles to be in readiness, in order that his family and friends might join the intended procession.

At three o'clock, twenty signal guns were discharged at the Park; the village bells struck up a festive peal; the flag was hoisted on the spire of the church; and upwards of forty respectable yeoman farmers and tenants, mounted on their horses decorated with ribands and flowers, had assembled in readiness to accompany the parties at the Park and Lodge on an excursion to meet the bride and bridegroom.

The church clock chimed the quarter past three, as the carriages of Major Snapwell and Mr. Seymour, and those of their guests, drawn by highly decorated horses, entered the village: the peasants immediately drew back, so as to form an avenue through which the party might pass, while shouts of gladness rent the air. Each horseman had provided a large bough of oak or elm, so that the cavalcade in motion appeared like a moving grove, and reminded Mr. Seymour of the advance of "Birnam Wood to Dunsinane." The carriages, preceded by a band of music, occupied the van of the procession; then came about fifty village maidens, each carrying in her hand a basket of flowers; next followed the horsemen; and the procession was closed by a dense group of peasants, who had come from all the country round. The vicar appeared on horseback, bustling in all directions, now conversing with the major, now with Mr. Seymour; at one time moderating the pace of the horsemen, and at another, keeping back the pedestrians, whose eagerness to push forward created an inconvenient crowd in the foremost ranks. Mr. Twaddleton held in his right hand a wand decorated with ivy leaves, and which resembled in appearance the thyrsus of Bacchus, except that the cone on its summit had been replaced by a bunch of roses. This was a classical conceit; and he fully explained to the major the reason of his having adopted such a device for his wand of office.

"The rose," said he, "was dedicated by Cupid to Harpocrates, the god of silence, to engage him to conceal the secrets of Venus; hence has this flower ever since been considered as the symbol of silence; for which reason it was customary to hang a rose over the banquetting-table, to signify that what was there spoken should be kept private, or 'under the rose;' whence, also, to present, or hold up, this flower to any person in discourse served, instead of an admonition, to intimate that it was time for such person to hold his peace. In like manner," continued the antiquary, "you will observe that, by virtue of my wand, I shall impress the obligation of silence upon the crowd, and easily calm any undue clamour that may arise."

The cavalcade had advanced little more than half a mile, when the major suggested the propriety of halting, until his nephew and niece should arrive; to this proposition the vicar readily acceded, and accordingly issued the necessary orders.

They had not, however, remained stationary above five minutes, when a carriage and four was seen at the brow of the hill, advancing in full speed. A general and simultaneous shout burst from the crowd; upon which the vicar raised his wand, and all was hushed. How far such an effect might be attributed to the influence of his wand, we shall leave the sagacious reader to determine; although we cannot but remark that, if the wonderful effects related of

Dr. Doseall's *Stethescope* * be true, we really cannot see why we should question the power of the vicar's wand, or indeed that of any witch's broomstick in Christendom."

"Observed you not the power of my talisman?" exclaimed the vicar, who was at that moment standing near the window of the major's carriage. The party smiled at so striking an instance of classical credulity; and Mr. Twaddleton, highly gratified by his triumph, rode forward to the chariot, which was not more than two hundred yards distant. It contained Mr. and Mrs. Beacham, whom the vicar no sooner perceived than he again raised his wand, and again witnessed the influence of its spell. The chariot instantly stopped, and, in the next moment, Mr. Twaddleton was seen in earnest conversation with the travellers. He informed them that the group they saw was a cavalcade of villagers, who had been awaiting their arrival on the road, in order to escort them in rural triumph to Osterley Park. He then presented Mr. Beacham with a bag of nuts, "that the bridegroom," as he said, "might be enabled to comply with the ancient Roman custom * of throwing nuts amongst the boys to be scrambled;—*sparge, marite, nuces*, as Virgil has it;—*da nuces pueris*, as Catullus sings." Mr. Beacham held the vicar in too much respect, to laugh at his eccentricities, and he therefore accepted the bag, with a determination to gratify his wishes in so harmless a whim.

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* This instrument has been alluded to at page 166. of the second volume; and so successfully, it is reported, did the doctor employ it, that he was enabled to discover the state of the heart in all those who would submit to the operation; indeed we are informed that his shop, on a Sunday morning, was crowded with applicants, who were doubtful of the real state of their own hearts, or anxious to ascertain that of their friends. In examining the heart of Miss Ryland, the doctor had formerly detected a singular irregularity in its pulsations, which was no sooner described to the vicar, than he, at once, pointed out its analogy to Sapphic metre.

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* Many reasons have been assigned for this custom; the more commonly received opinion is, that it was intended as a token of the bridegroom having left off childish diversions, and entered on a more serious state of life; whence *nucibus relictis* has passed into a proverb. This conjecture is favoured by Catullus:—

"Satis diu
Lusisti nucibus. Lubet
Jam servire Thalassio.

We have already stated (vol. ii. p. 5.) that *nuces* were played with like our marbles; the custom, therefore, might be intended to express that the bridegroom had deserted his play-things.

Mr. Twaddleton now returned to the assembled multitude.

"I perceive it is my nephew and his bride," exclaimed the major, as he thrust his head out of the carriage-window. "John, open the door — let down the steps: — while the vicar is issuing his orders, I will walk to the chaise."

The door was opened; and the major forthwith proceeded to welcome the return of his adopted children.

"We are all ready, sir," exclaimed Jerry Styles, who on this occasion acted as aide-de-camp to his worthy master; "but we await the presence of the major."

The vicar perceived that he was still talking at the door of the chaise, and in order, therefore, to put an end to the conversation, he pointed his talismanic wand; but, alas! it completely failed in its operation; the major heeded it not. Mr. Twaddleton then hallooed, but with no better success; a circumstance which, after the failure of his rod, did not greatly displease him; he therefore rode forward, and having remonstrated on the impropriety of any longer trespassing upon the patience of the multitude, the major obeyed the summons, and re-entered his carriage.

Jerry Styles was now directed to forward the two messengers to Osterley Park; and he accordingly opened a basket, from which flew two carrier pigeons, who immediately soared into the air, and having attained their greatest altitude, and remained apparently stationary for a few seconds, darted off in the direction of Osterley Park; every eye was steadfastly fixed upon the birds; and a murmur of satisfaction and wonder ran through the ranks, as the sagacious animals lessened in the distance. (1)

The musicians now struck up a grand march; —the whole cavalcade was in motion. Mr. Beacham's chariot having been drawn on one side of the road, the carriages and horsemen proceeded to take their stations in the rear; the company in the former kissing their hands, and waving their handkerchiefs, while the latter lowered their branches, and cheered, as they passed.

The damsels, in advance of Mr. Beacham's carriage, opened their baskets, and strewed the road with flowers as they moved forward.

"Hark!" exclaimed the major: "the pigeons have arrived at the Park, and my orders have been faithfully obeyed: they are firing a salute."

"And it has been heard at the village," said the vicar; "for the bells have just commenced their peal of welcome." But we are exhausting the patience of our readers with the details of a ceremony, in which it is very probable they may feel but little interest; although we freely confess that, to ourselves, few pageants have such attractive charms as those innocent and simple manifestations of genuine feeling which are to be met with in rural life, where the heart has not yet been chilled by that benumbing influence of what has been termed "the progress of civilisation;" and which has exchanged the free and warm impulses of our nature for cold and studied forms, or for an artful display of factitious sentiment.

During the progress of the procession through the village, Mr. Beacham had not been unmindful of the vicar's request: he poured a shower of nuts amongst the boys, which occasioned much frolic, and good-humoured contention; while the peasants caught and cracked them, without any suspicion of the Roman custom they were assisting to perpetuate.

Having arrived at Osterley Park, the horsemen formed a double line, through which the several carriages passed. The gates were then closed; and the vicar, stepping forward, thus addressed the assembled multitude: —

"Well-beloved friends, and parishioners, I am desired by Major Snapwell to inform you that refreshments have been prepared in the village, of which you may all partake on your return. Your admission into the Park this evening would interfere with those arrangements which are in progress for to-morrow's jubilee: let me, therefore, request that you will all retire peaceably. After your refreshment, every person who may inscribe his name in a book provided for that purpose at the village inn will receive a ticket for the ensuing fête; but, to avoid confusion, you are requested to register the district to which you belong, for it is intended that the parish of the bearer shall be notified by the colour of his ticket. The fête will commence at ten o'clock, and ample directions for your guidance will be placarded in different parts of the Park; and so, my worthy friends, I bid you all, for the present, farewell."

In compliance with this intimation, the whole assembly, after having given three hearty cheers, retired peaceably and well satisfied to the village; where several barrels of beer had been disposed in readiness for the libation.

The vicar, after he had completed his harangue, rejoined the party at the Park, where its hospitable owner had prepared a sumptuous dinner. It was, however, proposed that the vicar, with the major, and such of his guests as wished to inspect the preparations, should previously walk round the grounds. Tom and his sisters begged that they might be included in the party; a request which their father readily granted, as he said that some opportunity might occur for explaining the nature of those exhibitions which they were to witness on the following day. The same feeling induced Mr. and Mrs. Beacham and several other visitors to join the party, hoping that they also might profit from the discourse which Mr. Seymour intended to hold for the instruction of his children. The reader will probably be induced, for similar reasons, to accompany them. If he has attentively read the preceding volumes of this work, we hope he has become convinced that the lessons of youth may occasionally convey instruction as well as amusement to those of riper years.

Ned Hopkins having been summoned to attend the party, and receive the final orders of the vicar, they proceeded to the elm-meadow, where the grand fair was to be held, and in which were disposed a long line of booths for the motley exhibitions to which they were dedicated.

"What have we here?" exclaimed the major, as he entered the meadow; "a row of poles!"

"Ned Hopkins," cried the vicar, "how has it happened that the ropes have not been affixed to these poles? Have I not said that every arrangement must be completed this evening? Those poles," continued the vicar, addressing himself to Major Snapwell, "are intended for swings, from which the younger peasants will, doubtless, derive much amusement, while their sires are engaged, in the adjoining field, by the more manly exercises of quoits, foot-racing, wrestling, hurling, &c. You are, of course, aware, gentlemen, that in admitting the swing amongst the pastimes of the day, I have the support of classical authority: its origin may be traced to the Icarian games, the celebration of which consisted in persons balancing themselves on cords, attached to two trees; or, in other words, in swinging. They were instituted in commemoration of the death of Erigone, who no sooner discovered the murder of her father Icarus, than she piously hung herself at his tomb."

"You are a most indefatigable antiquary, vicar; but to perpetuate and respect a custom which was instituted to commemorate an act of suicide is surely carrying your veneration for antiquity beyond the pale of morality; but never before this moment have I heard of these Icarian games," said Mr. Seymour.

"Icarus, the father of Erigone," replied the vicar, "having given some peasants a quantity of wine to drink, was slain by their companions, who, not being acquainted with its effects, concluded that he had supplied them with poison. Upon which, it is said, that the wives of the murderers were all seized with madness, which lasted till the oracle had ordained feasts in honour of Icarus; whence came the Icarian games, and which, divested of the superstitions, continue at this very day to be celebrated throughout the country by the youths of every village, who are little aware of the tragedy from which the pastime originated."

"It is certainly very curious," said the major, "to observe how frequently a popular ceremony or custom has survived the tradition of its origin; it is thus, for instance, that the fond mother still suspends the coral toy around the neck of her infant, without being in the least aware of the superstitious belief from which the custom sprang (2); and I have little doubt but that we shall to-morrow hear the chorus of 'Derry-down' re-echoed by those who probably never heard of the Druids, and much less of the choral hymns with which their groves resounded, at the time of gathering the missletoe. But let us proceed; for what has yonder stage been erected?"

"That is the *hoistings*, sir," exclaimed Ned Hopkins, "from which Giles Gingerly, the celebrated American merry-andrew will exhibit his buffoonery, and vend his nostrums."

"Hoistings! why, Ned, you pronounce the word as though your mouth were filled with hot pudding," said the major.

" I ask your pardon, sir," replied Ned; " but my father would never suffer me to pronounce it in any other manner; for he always maintained that *hustings* was a corruption for *hoistings*, it being a stage upon which the actor is *hoisted* or elevated above the surrounding crowd."

" I believe he is right," muttered the vicar.

" Papa," said Tom, " pray tell me what is a merry-andrew."

" Ask the vicar," replied his father.

" 'Ask the vicar,' " repeated Mr. Twaddleton, in a plaintive tone: " upon my word, the vicar's bank will soon become insolvent, if you thus draw upon it at sight. I am, however, happy that upon this occasion I can honour your draft. Know, then, that the Mountebank, who united the professions of joculator and physician, was of ancient date, and during the two last centuries has figured away with considerable success. He usually appears on a temporary stage, and prefaces the vending of his nostrums with a pompous harangue; and, the better to attract the notice of the gaping spectators, he displays some of the performances practised by the jugglers, while his inseparable companion, the *bourdour*, exhibits numerous tricks, and puts the populace in good humour by wit and raillery. The medical fraternity, known in England by the name of *Merry-andrews*, and who are the companions of the mountebank, derived their foundation from Dr. Andrew Boorde, who lived in the reigns of Henry VIII., Edward VI., and Queen Mary, and was constantly in the habit of frequenting fairs and markets, at which he harangued the populace: his speeches were extremely humorous, and occasioned considerable mirth; but, notwithstanding the infallibility of his nostrums, like Paracelsus, he died with a bottle of his elixir in his pocket. His successors in the same line naturally endeavoured to emulate the humour of their master, and hence this whole class of vagabond tinkers of flesh and bone acquired the generic appellation of '*Merry-andrews*.' "

" And pray what are *nostrums?*" asked Louisa.

" '*Nostrum*,' my dear, signifies *our own*, and is applied to any medicine which is prepared by a secret process, and sold for the private advantage of an individual; but, since secrecy is never used on such occasions except as a cloak for imposture, the word very generally conveys an expression of ridicule or contempt."

The company proceeded in their inspection.

"What have we there, Ned Hopkins?" said Mr. Seymour, as he pointed to a booth of larger dimensions than those which surrounded it.

"In that booth, 'the Emperor of all the Conjurors' will perform his wonderful art of 'sleight-of-hand,'" replied Ned.

"A lineal descendant of the *Tragetour* of the fourteenth century," observed the vicar; "a class of artists who, with the assistance of dexterity of execution, and various kinds of machinery, deceived the eyes of the spectators, and produced such illusions as were usually supposed to be the effect of enchantment; on which account, they were frequently ranked with magicians, sorcerers, and witches. They were greatly encouraged in the middle ages, and travelled in large companies, carrying with them such machinery as was necessary for the performance of their deceptions."

"And what may be the etymology of *tragetour?*" asked Mr. Seymour.

"A late ingenious writer supposes it to be derived from *trebuchet*, or *trap-door*, of which he made frequent use during his performance."

The company passed to the next booth.

"There," said Ned, "will be exhibited vaulting, tumbling, jumping through hoops, balancing, grotesque dances by the clown, and dancing upon the tight-rope."

"The tragetour rarely executed this part of the performance himself," said the vicar, "but left it to some of his confederates."

"And yet I should have thought it the most profitable department of the art," observed the major; "for it was so patronised as to secure the reception of its professors into the houses of the nobility. In the reign of Edward II. a tumbler rode before the king, and so delighted His Majesty, that he rewarded him with a gratuity of twenty shillings, a very considerable sum in those days."

"In the caravan that you see yonder," said Ned Hopkins, "is the apparatus of the famous glass-blower, who will exhibit his surprising art, and present a specimen to any one who will give him a penny. I have no doubt he will have ample custom for the stars he has prepared in commemoration of the present jubilee. My young masters," added Ned, "will be much astonished at his appearance; for he is dressed in a full-bottomed wig of glass; and all his buttons are of the same materials. As he proposes to read a lecture upon the history of glass-blowing, I hope my young masters will not fail to attend his exhibition."

The whole party, having expressed their satisfaction at the genius which Ned Hopkins had displayed in selecting and arranging the various kinds of amusement, were conducted by the vicar to a small enclosure, at a short distance from the fair, which he had appropriated to the youths of the village, who had been trained to perform the "*Ludus Trojæ*," according to the description left us by Virgil in the fifth Æneid.

"I shall be curious to witness the sport," said the major, "for Lazius asserts, in his commentaries upon the Roman Republic, that the jousts and tournaments, so much in fashion about two or three hundred years ago, were indebted for their origin to this game; and that '*Tournamenta*' is but a corruption of '*Trojamenta*.'"

"Undoubtedly," replied the vicar; "and the learned and noble Du Franse entertains the same opinion; by some the word has been derived from the French *tourner*, to turn round with agility; yet the exercises have so much resemblance, as to prove the one an imitation of the other."

"Come, come, my good friend," exclaimed the honest major, "all these preparations are highly laudable, and will, no doubt, afford satisfaction to the spectators, for whose amusement they have been designed; but there are other senses, besides the eye and ear, to be gratified upon this occasion. I have not yet observed any arrangements for the dinner."

"Fear not, major; the awning which has been erected for that purpose is within sight; observe you not the banners which are floating yonder?" said the vicar.

"Ay, ay, to be sure I do; and let me tell you, that you have taken up a very snug position."

Tables had been arranged, under an awning of canvass, in the form of a cross, and were capable of accommodating about two hundred persons. On a platform, somewhat elevated, was another table appropriated to the major and his guests, on which covers were laid for forty.

"You perceive, major," said Mr. Twaddleton, as they approached the scene of future action, "that the fare which has been provided is simple, but substantial, and I trust will be considered as no less according with English hospitality, than with classical propriety."

"The beef certainly predominates," said the major, "and I observe that most of the joints are roasted."

"Quite correct, sir; the ox is the animal most frequently spoken of, as furnishing food for ancient heroes; and you will remember that Homer rarely mentions any other than *roasted* meat."

"I perceive that you have been more miscellaneous in your arrangement of the upper table."

"I have placed before you a chine of beef, because Menelaus set that dish before Telemachus at the marriage-feast of his son; but I thought it right to dedicate a part of your table to the display of that allegorical confectionary which the London artist has executed with such refined taste."

“ Upon my word, those chariots are exquisitely modelled,” said the major.

“ From drawings which were copied, for the occasion, from the engravings of Montfauçon.”

“ You have placed the car of Venus opposite to the chair in which Mrs. Beacham is to sit; that is quite correct.”

“ Yes, and you may observe that the goddess is beckoning an airy figure from the group of rocks which form the back-ground, in allusion to the part which Echo performed, in so happily bringing the lovers together.”

“ Every dish, to my mind, gentlemen, appears to bear some allegorical meaning,” cried Ned Hopkins. “ Look at those red-coated prawns, which peep so slyly from the bed of parsley in which they lie in ambush; and say if you are not reminded of the future race of heroes who will emulate the military prowess of their valiant ancestor.”

“ Ned, you are a most insufferable wag,” said the major, as he laughed and chuckled at the joke.

“ Then again, observe those rosy-cheeked apples, which look out from among their leaves, like laughing Cupids peeping at each other through screens of foliage."

"A truce to this badinage," cried the major. "I wish to know what seats are to be appropriated to my young friends the little Seymours."

"I regret, extremely do I regret, to say, that they cannot with propriety join our party," replied the vicar, gravely.

"Not join the party! zounds, sir, but I insist upon it;—not join the party!—Why, sir—"

"Be calm, major; and believe me that I shall feel the privation as keenly as yourself; but would you countenance a measure, which is decidedly in opposition to every classical authority? Never, as Suetonius has expressly declared, did the young Cæsars, Caius and Lucius, eat at the table of Augustus, until they had assumed the *toga virilis*."

"A fig for Suetonius; he is not to be trusted; has it not been said that while he exposed the deformities of the Cæsars, he wrote with all the licentiousness and extravagance with which they lived? Besides, can we trust the opinion of a man, on a subject of etiquette, who was banished from the court for want of attention and respect to the Empress Sabina? You must produce some better authority, my dear Mr. Twaddleton; search the Grecian writers; depend upon it that some direct or implied sanction to the plan is to be discovered; the oracles of old may generally be so interpreted as to meet the wishes of the translator."

"Gently, Major Snapwell; speak not so irreverently of the luminaries of antiquity; nor expect me to distort passages from their original and intended significations. An idea, however, has just struck me, which may, possibly, be turned to your advantage; and yet there are many difficulties; for it cannot be said that this feast has been conducted with the utmost frugality; and, therefore, must not be compared with the Lacedemonian '*Syssitia*,' or public entertainments, whither the youths were obliged, by the lawgiver, to repair as to schools of temperance and sobriety, and where, by the example and discourse of the elder men, they were trained to good manners and useful knowledge."

"A case exactly in point," exclaimed the major. "Must not the classical character of our entertainment convey instruction? I vow it runs parallel in every particular with the Syssitia of Lacedemon; and I therefore affirm, that it would be illegal, according to the law of Lycurgus, to prevent the presence of the young Seymours."

"Your argument has colour, major; I must admit that Mr. Seymour's lessons are too valuable to be lost; well, I consent; it shall be a Lacedemonian entertainment, and my young friends shall be accordingly accommodated with seats."

On their return from the banqueting tables, the party inspected the preparations for the fire-works, and the ships constructed for the naumachia; we shall, however, at present decline offering any description, as we prefer explaining them in operation.

The reader will now be pleased to imagine that the party having returned to the mansion, had partaken of the hospitable repast which the major had provided for them; he may farther suppose that tea had been served up, and the amusements of the evening commenced; for it is at this exact moment that the course of our narrative is resumed. Mrs. Beacham was delighting the assembly by a splendid display of her musical talents; the major and Mr. Seymour were engaged in a game of chess.

"There you sit, gentlemen," exclaimed the vicar, "so absorbed in your game, as to have remained quite insensible to the sweet sounds with which Mrs. Beacham has been charming us; but you stand excused, for Seneca admits the fascinating power of the '*ludus latrunculorum*,' or game of chess. You no doubt remember the story that he tells us of one Canius Julius, who, having been sentenced to death by Caligula, was found by the centurion, when he came to conduct him to execution, so interested in a game of the '*latrunculi*,' as at first to be insensible to the summons, and that he did not prepare to depart until he had counted his men, and desired the centurion to bear witness to his having one more piece on the board than his adversary, so that the latter might not boast of a victory after his death."

"Indeed!" said the major; "but unfortunately for your story, the ancients were not acquainted with the game of chess."

"What absurd proposition am I next to expect?" cried Mr. Twaddleton. "You surely cannot have read the poem to Piso, which some will have to be Ovid's, others Lucian's: but no matter; it is an ancient poem, and accurately describes the game of '*latrunculi.*' I myself believe, from a particular line in Sophocles, that chess was invented by Palamedes, at the siege of Troy; although Seneca attributes it to Chilon, one of the seven Grecian sages. My friend Mr. Seymour, who is, upon all occasions, desirous of imparting wisdom through the medium of games, and of 'turning sport into science,' will no doubt agree with those who fancy that it was contrived by Pyrrhus, king of Epirus, as a method of instructing his soldiers in the military art; and I must admit that the game expresses the chance and order of war so very happily, that no place can lay so just a claim to its invention as the camp: '*ludimus effigiem belli* *,' as Vida says."

"Check to your king!" cried the major; "while you are considering of the best way to get his majesty out of the scrape, I will endeavour to extricate the vicar out of the quagmire in which he is floundering. My dear

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* "War's harmless shape we sing, and boxen trains
Of youth, encount'ring on the *cedar* plains.
How two tall kings, by different armour known,
Traverse the field, and combat for renown."

Mr. Twaddleton," continued the major, "you speak as if it were an admitted fact that the '*ludus latrunculorum*' was synonymous with our chess. I admit that it was a game played with *Tesseræ* or squares, and *Calculi* or pieces; but it does not follow that it must have been chess; indeed, the learned Dr. Hyde, whose researches into Oriental games are as much distinguished for accurate discrimination as for profound scholarship, considers it to have resembled our *draughts*.*

"You are to move, major," said Mr. Seymour.

"Then I shall take your castle, and open a fresh battery upon the vicar," replied Major Snapwell.

"So you may," cried Mr. Twaddleton, "but you will not easily drive me from my position; supported as I am by Vossius and Salmasius, and an army of valiant combatants."

"The learned Hyde has endeavoured to prove that chess was first invented in India, and passed from thence to Persia and Arabia.

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* "'Ludus Latrunculorum;' ludus, anglice dicitur *Draughts*, a trahendo calculos." — HYDE *de Ludis Orientalium*. Oxon. 1694.

Fabricius considered it a Persian game, and I must say that I am inclined to coincide with him. The terms in present use may evidently be traced to an Oriental source. *Schach*, in the Persian language, signifies king, and *schachmat*, whence our *check-mate*, the king is dead, the original words having been transformed by progressive changes; thus we have *schach*, *echecs*, *chess*; and by a whimsical concurrence of circumstances, have arisen the English words *check*, and *exchequer*."

"I take your *queen*," cried Mr. Seymour.

"Ay; and I take a *bishop* in return," said the major.

"Well," observed the vicar, "if an Oriental nation really gave origin to the game, it could not, at all events, have been China; since the policy of that people is to exclude females from every kind and degree of influence and power, whereas the *queen* at chess is a powerful and important piece."

"You must not lay too much stress upon the names of the several pieces," observed the major, "since they have varied in different ages and countries. The castle is sometimes called the *rook*, from the Italian word *rocca*, which signifies a fortress placed on a rock; the piece which we call the *Bishop* has been termed by English writers *alphan*, *aufin*, &c., from an Arabic word, signifying an elephant; sometimes it was named an *archer*; by the Germans, the *hound* or *runner*; by Russians and Swedes, the *elephant*; by Poles, the *priest*; and by the French, at a very early period, the *fou* or *fool*; the reason of this last appellation seems to be, that as this piece stands on the sides of the king and queen, some wag of the times styled it the *fool*, because anciently royal personages were commonly thus attended, from want of other means of amusing themselves."

"You cannot thus account for our term *bishop*," observed Mr. Seymour, "as our kings and queens have never had such attendants."

"Nor is it very easy to ascertain the period at which it was introduced," replied the major; "in Caxton's time it was styled the *elphyn*. I should think it probable that the change of name took place after the Reformation."

"It is probable that the pieces not only underwent changes in name, but changes in value or power," observed Mr. Seymour, "as the game descended through different ages and countries."

Mrs. Beacham, who had been for some time listening with much interest to the curious discourse we have just related, here ventured to ask a question.

"As you appear to have taken some trouble to ascertain the origin of this game, you can perhaps inform me at what period it was introduced into England."

The major replied, that the learned Hyde supposed it to have been first known in our country about the time of the Conquest; but that Mr. Barrington believed it to have been introduced during the thirteenth century, upon the return of Edward I. from the Holy Land, where he continued so long, and was attended by so many English.

"It is certain that our ancestors played much at chess before the general introduction of cards," observed the vicar, "as no fewer than twenty-six English families have emblazoned chess-boards and chess-rooks in their arms, and it must therefore have been considered a valuable accomplishment."

"Cards," observed the major, "must have

been known in England previous to the time of Edward IV.; since a statute was passed in that reign against their importation; but they did not become general for many years, and the progress of the custom appears to have been extremely slow."

"Check,—and mate!" exclaimed Mr. Seymour.

"Upon my word, I have lost the game. Mr. Twaddleton, I lay this to your account," said the major; "you ought not, sir, to have intruded your antiquarian discussions at such a time."

"It is quite natural that you should feel mortified by your defeat: a person never likes to be beat at chess, because it is a trial of skill and address; chance has no place, and no one, therefore, loses except in consequence of the superiority of his adversary. I must say," continued the vicar, "that this, in my view of the matter, is an imperfection in the game; for, if it be the type or representative of a military campaign, fortune should have some share in deciding the fate of the day; and, if I remember correctly, Sir William Jones has stated that the use of dice, to regulate the moves, was formerly introduced in the East."

" You must give me my revenge, Mr. Seymour," said the nettled major; and turning towards the vicar, he informed his reverend friend that upon any other occasion he should be most happy to resume the discussion, but at present he must beg him to desist from his literary persecution.

CHAP. III.

A SHORT DIALOGUE, CONTAINING SOME FUN, AND A LITTLE PHILOSOPHY. — THE ARRIVAL OF THE POPULACE AT OSTERLEY PARK. — THE COMMENCEMENT OF THE FESTIVITIES. — DANCING ON THE TIGHT AND SLACK ROPE. — BALANCING. — CONJURING. — OPTICAL ILLUSIONS. — VARIOUS GAMES. — THE PENTHALUM. — THE BANQUET. — — GRAND DISPLAY OF FIREWORKS. — CONCLUSION.

NEVER had the rosy fingers of Aurora shown so much reluctance in unbarring the gates of the East, as on the morning of the Osterley Jubilee; at least, so thought about half a score peasants, who, fevered by anxiety and expectation, had arisen from their beds long before the break of day, and having wandered about the green lanes and meadows, at length came to the village inn, whither they were attracted by the shouts and songs of Ned Hopkins and his merry companions, who, to use a cant expression, had been 'keeping it *up*,' by pouring *down* the punch of mine hostess at the Bag of Nails?

"Is it not very strange that the sun should not have yet risen?" said one of the villagers, as he entered the parlour where the aforesaid party were enjoying their merriment.

"If the sun has overslept himself," replied Giles Gingerly, "depend upon it, Master Hodge, that all the clocks in your village are in the secret; for they declare, without changing a feature in their faces, that it is not yet four o'clock."

"Four o'clock!" exclaimed Crank Smirky, the conjuror, "why, it cannot be two; do you really mean to say that more than three hours have elapsed since our supper? I'll be bound for it, those hanged pendulums have been stealing a march upon us, by beating double quick time."

"It may be so," replied Ned, with a roguish twinkle of his eye, "for those pendulums have always been notorious for their *waggery*."

"Gentlemen!" exclaimed a squat and cadaverous-looking personage at the top of the table, "I agree with our friend, Mr. *what's his name*, that it must be six or seven o'clock; it is too bad to sit thus piping all night, when a day of great exertion is dawning upon us — but — but —"

Here the squat gentleman yawned so tremendously that the conclusion of the sentence became inarticulate.

"If it be later than four, the clocks must be too slow; and not too fast, as Crank Smirky conjectures," replied Mr. Toby Tiffin, a noted performer on the salt-box; "but pendulums are ill-used servants, and I should not wonder, if it turns out that they have all *struck* for wages."

"There you are quite out, Master Toby," replied Ned Hopkins, "for the pendulum never strikes on any occasion, although I confess that he frequently urges his master to do so; and as to his wages, why do not you know that he always goes upon *tick?*"

"Yes, and therein is the cruelty of his case," cried Toby; "since the master for whom he labours is constantly stretching forth his hands, and admonishing every idler that passes to be ready for his reckoning."

How forcibly does the above conversation illustrate a truth, which has been so frequently enforced in a graver and more philosophical manner,—that the same portion of time may be very differently estimated by persons differently occupied; so that it is possible some may think half an hour as long as we do a day. The time of a wise man is lengthened by the number and variety of his ideas, as that of the idler is by his *ennui:* to the former it appears long, but not tedious, because he distinguishes every moment of it with useful or amusing thoughts; to the latter it appears long, because he does not know what to do with it; or in other words, the one is always enjoying time, and the other always wishing it away.

At length the sun arose; but indignant no doubt at the accusations he had so unjustly suffered, he immediately veiled his fiery countenance in dark and lowering clouds: here, then, was a fresh source of doubt and anxiety; would the day be rainy? The gardener at Overton Lodge was immediately sought and consulted; and, cheering as were his predictions, they scarcely succeeded in dispelling the gloom which shaded many a fair countenance. The apprehension of disappointment was, however, suddenly relieved; for between nine and ten o'clock the sun re-appeared, beaming in all his glory, and shedding the brightest refulgence on the scene of the approaching festivities. At this period hundreds of villagers, dressed in their holyday attire, were seen pouring along the high road, or winding their way through the verdant valleys. So admirable had been the arrangements for the admission of the populace into the park, that great as was the concourse of spectators, not the slightest impediment occurred during their entrance.

At half-past ten o'clock the whole population of the country had assembled; the various performers were on their respective stages; and the arrival of Major Snapwell and his guests was eagerly expected, as a signal for the commencement of the festivities of the day.

At length a distant murmur was heard in the direction of the house, which gradually increased as it approached the meadow; until it swelled into one grand and universal chorus. The vicar appeared with his wand of office, which he no sooner waved in the air than the murmur gradually subsided. Major Snapwell and his friends, Harry Beacham and his bride, and the Seymours with their children, followed. The several bands, stationed on the platforms erected before the show-booths, simultaneously struck up the national anthem of God save the King, in which the whole multitude joined, and produced one of the most surprising and thrilling effects ever witnessed.

There were eight booths appropriated to the exhibitions; and it had been arranged that each should commence at the same time, and repeat its performances eight times during the day; so that by dividing the spectators into eight groups, and delivering to each person a ticket distinguished by a particular number, every spectator at once knew the booth into which he was to enter; and having witnessed the exhibition, he was directed to exchange his ticket; by which means every chance of confusion was avoided, and each person was enabled to witness, successcessively, every performance.

The vicar and the party entered the first booth, and were followed by all those whose ticket was distinguished by No. 1.; those of No. 2. at the same time entered the second booth, and so on.

The first show was appropriated to the various exhibitions of vaulting, tumbling, balancing, and rope-dancing. During the performances of the balancer, Tom Seymour's attention was riveted on the artist; he watched every movement, and examined its effect in preserving the centre of gravity within the base. "Papa," cried the delighted boy, "I never experienced so much interest in a performance of this kind, until I was capable of explaining the principles upon which it was conducted. I have attentively followed every change of position, and discovered the effect of such changes upon the line of direction."* As to the *wire-dancing*, Tom observed that he saw very plainly the swinging of the wire backwards and forwards diminished the difficulty, and assisted the actor in keeping his equipoise.

Mr. Seymour was highly delighted with these remarks; and, casting an intelligible look at Mr. Twaddleton, who was seated near him, he exclaimed, "Well, vicar, you will surely now admit that the pleasures which arise from sport are heightened by the admixture of science."

"My dear Mr. Seymour," replied the vicar, "you well know that I have long since become a convert to your principles; I confess, however, had that not been the case, the expressions of satisfaction and delight which have just fallen from my little playmate, Tom, would have removed all my prejudices."

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* See Vol. I. p. 245.

"See, see!" exclaimed Louisa, "how very extraordinary! I declare that the plate, sword, key, and tobacco-pipe, are all balanced as they revolve on the chin of the performer."

"And do not you know, Louisa," replied Tom, "that the revolution of the plate and sword, which appears to render the execution so much more astonishing, actually diminishes the difficulty of the performance?" *

Thus did Tom Seymour continue, during the whole of the exhibition, to point out successively the philosophical principles upon which each of the tricks might be supposed to depend.

The next booth into which our party entered was that of Crank Smirky, the celebrated conjuror, who invited the company to witness his wonderful display of the art of legerdemain; he was dressed as an astrologer, with a loose gown of green velvet, and a red cap; he had a long grey beard, and his nose was bestraddled by a pair of green spectacles.

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* Vol. I. p. 257.

"Ladies and gentlemen," said the mystic professor, "I shall have the honour of convincing you this day, that my single hand is more than a match for all the sharp eyes of Overton. You will admit that a beautiful eye makes silence eloquent, a kind eye, contradiction an assent, and an enraged eye, beauty deformed; but my hand shall, by its magic influence, make eloquence dumb; assent a contradiction, and deformity beautiful."

So saying, the professor beckoned a villager, who sat near the stage, to approach and assist him in the performance of his first grand trick.

"Dobby," exclaimed his terrified wife, "sit thee still; that man has dealings with the old one; I would not that he should touch your garment for all the gingerbread in the fair."

This exclamation of the terrified wife set the whole audience in a roar, and produced a confusion which the skilful conjuror is always anxious to create, when any sly work is to be performed. In truth, this scene had been previously concerted by the renowned Crank Smirky, who had engaged this said Dobby as his confederate. A series of very amusing tricks were then performed with cards and counters; such, for instance, as desiring some person to draw a card from the pack, and having observed what it was, to return it; which card, to the wonder of the company, was immediately found in Dobby's pocket. Mr. Seymour informed his children that the explanation of this trick would serve to show the manner in which most of the deceptions on cards were performed. He said, that the conjuror's pack of cards always contained a card, technically termed a '*brief* card,' or 'the *old gentleman*,' which is one made on purpose by the card-maker, and is a little larger than any of the rest; the performer always knows it by feeling it, and can easily force it upon the unsuspecting drawer; should he, however, attempt to take any other, the conjuror, under some pretence, shuffles again, till at length he induces him to take the one intended for him. After the card has been introduced again into the pack, the performer, without any difficulty, withdraws it, and the confederate is called upon to produce the duplicate which had been previously placed in his pocket.

The children were told that the several deceptions with coin, or counters, which they had witnessed, were accomplished by a species of dexterity acquired only by practice, and was termed '*palming*;' it consisted in being able to retain a shilling, halfpenny, or counter, in the palm of the hand, while it remained extended; thus the performer desires any one to reckon five pieces, which are accordingly placed on the table before him, the conjuror then takes them up, and having dexterously palmed one, he adds it to the number as he places it in the hand of the unsuspecting person.

Tom and his sisters expressed themselves much pleased and surprised with the dexterity of the performer; "but," added the intelligent boy, "I should be much more gratified by tricks that were indebted for their mystery to some philosophical principle."

Mr. Seymour and the vicar again interchanged looks, that strongly marked the feelings which had been excited by this observation. The former turning to his son, said, that if he waited patiently, he would shortly be gratified in that wish, for he knew Crank Smirky was prepared to exhibit some recreations in divination, that were founded on the science of numbers.

Nor was Mr. Seymour mistaken; for after a few more specimens of his dexterity, the conjuror requested Mr. Twaddleton, who was sitting directly in his front, to take an *even* number of counters in one hand, and an *odd* number in the other; and he would tell him, he said, in which hand he held the even number. Mr. Twaddleton having complied with the request, he was farther desired to multiply the number in the right hand by any *even* number he pleased, as for instance 2; and that in the left hand by an odd number, as 3.

" I have done so," said the vicar.

" Then be pleased to add together the two products, and tell me whether the sum be odd or even."

" It is odd," replied Mr. Twaddleton.

" If so," said the conjuror, " the even number of counters will be in your right hand."

The vicar exposed the counters, and admitted the correctness of the conjuror's decision. (3)

" Ladies and gentlemen," exclaimed the man of mystery, " I now humbly crave your silent attention, while I exhibit one of the most wonderful examples of my art. Here is a ring,— there a shilling, — and there a glove. I shall presently request each of the three gentlemen before me, to take one of those articles, so secretly as to prevent the possibility of my discovering the choice he may have made. I have here, you perceive, twenty-four counters; *one* of which I shall give to you, Mr. Seymour; *two* to you, reverend sir; and *three* to you, my young philosopher; the remaining eighteen shall remain on the table. Now, gentlemen, I shall retire, and during my absence, you will be so good as to distribute the three articles in any way you may think proper."

The professor, accordingly, walked off the stage; when Mr. Seymour took the ring; the vicar the shilling; and Tom Seymour the glove. The conjuror, on his return, said that he had one more favour to request, that the person who had the ring should take from the eighteen counters on the table as many as he already possessed; the one with the shilling, twice as many; and the person with the glove, four times as many as he before possessed. The conjuror again retired, in order that the distribution might be made without his observing it. On returning, the conjuror, having first cast his eye upon the counters that remained on the table, informed the company that Mr. Seymour had taken the ring, Mr. Twaddleton the shilling, and the young gentleman the glove. The moment the parties assented to this decision, the whole company expressed their satisfaction and astonishment by thunders of applause.

"That is really very ingenious," observed the vicar.

"How could he perform it?" said Tom: "it is evident that his only guide was the number of counters left on the board."

"I understand the process by which it was accomplished, and will endeavour, at some future time, to explain it," replied Mr. Seymour. (4)

A number of similar tricks followed, all of which depended upon some algebraical calculation; and the performance was concluded to the entire satisfaction of all present.

The next exhibition was of a very different character: it consisted in a variety of optical representations and illusions. The camera obscura presented a moving picture of the surrounding scene. The phantasmagoria exhibited a variety of ghastly objects, which alternately receding from, and approaching the audience, called forth shrieks of terror and amazement. Amongst the most appalling of these figures, was the headless horseman of Sleepy Hollow, so inimitably described in the Sketch Book: it will be remembered that the body of this trooper having been buried in the church-yard, its ghost was believed to ride forth every night in quest of its head, and that the rushing speed with which he passed along the hollow, like a midnight blast, was owing to his being in a hurry to get back to the church-yard before day-break. This rapid movement was admirably represented in the phantasmagoria: at first the figure appeared extremely diminutive, and at a great distance; but almost immediately its size became gigantic, and it seemed as if within a few feet of the audience, and then suddenly vanished. After an instant of utter darkness, the figure was again visible at a great distance; the schoolmaster, Crane, was also seen belabouring the starveling ribs of his steed, old Gunpowder, and quickening his pace towards the very spot where the spectre was stationed. The whole audience were breathless with horror. Crane arrived at the bridge, over which the headless figure opposed his passage. "Mercy upon us!" cried a faint voice from one of the back seats, "the ghost has found his head, and is carrying it before him on the pommel of his saddle."—"Hush, hush," cried another voice; Crane's horse had taken fright; away he dashed through thick and thin; stones flying and sparks flashing at every bound. Crane's flimsy garments fluttered in the air, as he stretched his long lank body away over his horse's head, in the eagerness of his flight. The goblin pressed hard upon him; he was not more than a yard behind him, when he was seen to take up his head, and with gigantic force to hurl it at the pedagogue; it encountered his cranium with a tremendous crash; he was tumbled headlong in the dust; the goblin whisked past like a whirlwind, and the company were once again in entire darkness.

"Upon my word," exclaimed Mr. Seymour, "this is one of the most complete illusions I ever witnessed."

"It is most ingeniously managed," said the vicar.

"Papa," cried Tom, "I am quite impatient to learn how so extraordinary an effect can have been produced. You told me this morning that a phantasmagoria was nothing more than an improved magic lantern; but how is it possible for the slides to be so managed as to make the figures approach and retire from you, and above all, to make them move their bodies, and throw their arms into different attitudes?"

"In the first place, the figures only *appear* to approach you, for they are thrown upon a surface which never changes its place; the whole is therefore an optical illusion, arising from the fact that we estimate the distance of an object by its apparent magnitude; when, therefore, the figure began to diminish in size, the mind instantly assumed that it was receding from the eye; and the illusion was still farther heightened by the absence of all other objects by which it might be compared."

At this moment Mr. Seymour was interrupted by the appearance of the performer, who announced his intention of submitting another optical illusion, which he trusted would afford equal satisfaction.

"Papa," cried Tom, "how much do I regret my ignorance of optics. It is a cruel disappointment to me that I should witness so many curious exhibitions, without being able to understand the principles upon which they depend."

"I promise you, my dear boy," replied Mr. Seymour, "to instruct you in this branch of science during the Christmas vacation. Enjoy, therefore, the present amusements, and instead of repining at your ignorance, anticipate the pleasure which you will receive, when you shall be able to explain them."

A series of extraordinary effects were now exhibited by means of concave mirrors. Aërial images were produced, so illusive in their appearance, that the spectators could not believe in their immateriality, until they attempted to grasp them. In this manner were presented flowers, fruit, a human skull, and a dagger; the latter of which terrified the spectator by the sudden and violent manner in which its point approached him. With this illusion the amusements concluded; the light of day was admitted; and the performer stepping forward, announced the termination of his exhibition in the words of Shakspeare: —

"Our revels now are ended: these our actors,
As I foretold you, were all spirits, and
Are melted into air, into thin air."

The villagers, as they poured out of the booth, and mingled with their companions in the fair, with their wonted propensity for the marvellous, related, in most exaggerated terms, the wonders they had encountered in the region of shadows. Nothing is swallowed with more avidity than tales of mystery, especially if spiced with a few grains of horror; we cannot, therefore, be surprised at the anxiety so generally manifested by those who had not yet witnessed the optical performances to exchange their tickets for such as would secure their admission into the popular booth. The crowd, however, which had assembled round the spot was soon dispersed by the appearance of a placard, announcing the suspension of all the performances for two hours; and informing the populace that the interval would be devoted to various sports and pastimes in the adjoining field.

Before the spectators had quitted the fair for these new points of attraction, a flourish of trumpets was heard, and Giles Gingerly, the American mountebank, appeared on his stage, in the midst of the astonished multitude. He was an extremely tall and thin person, dressed in a suit of pepper and salt cloth; he wore a full bottomed wig, and carried in his hand that well known ensign of professional dignity, the gold-headed cane; which on every occasion of profound cogitation was carried to his nose with an air of imposing solemnity, where it remained motionless (we borrow a favourite expression of the doctor) until "his random thoughts were divested of their crudities, and duly concocted into rational opinion." His assistant, Jonathan Cramp, explained this habit of his master, by observing that, in all serious cases, two heads were better than one; but he never stated which head of the two sticks, whether that of the cane, or of the doctor, contributed most liberally upon these occasions; be this as it may, we are quite positive that many doctors, who have even prided themselves upon their orthodoxy, have, nevertheless, been quite incapable of delivering a sound judgment upon a difficult case, without the assistance of a supplementary head of this description.

The mountebank commenced his harangue, by stating that his celebrated *Powder of St. Nicholas* would be found an infallible remedy for every disease. "Let the most afflicted amongst you," said he, "approach my stage, and by testifying the healing powers of my panacea, infuse confidence and consolation into those who regard their cases desperate and hopeless." While the doctor was scattering these crumbs of comfort, his man Jonathan was observed approaching him, with what appeared a dying infant, in the last extremity of jaundice. "If he cures that child," shouted a voice from the crowd, "I, for one, will believe in him." The countenance of the young patient was of a deep yellow, its eyes appeared sunk in its head, its nose was contracted, and its lips, which were white, strangely contrasted with the saffron hue of the face. It wore a long white robe, which hung in dishabille, and betrayed the extreme emaciation of its body. The doctor, on perceiving this strange spectre, raised his hands in apparent displeasure, and frowning upon his assistant, desired him to remove it from his sight.

"Ay, ay," said one of the spectators, "I knew how it would be; he is a fine fellow, forsooth, to invite the most afflicted to be cured, and then to reject a poor jaundiced babe."

Jonathan Cramp, however, was not so easily repulsed; he seized one of the celebrated powders from the precious casket of his master, and presented it to the mouth of the infant; the crowd were on the tiptoe of expectation to witness the effects of this vaunted remedy. In a few moments its features were thrown into the most horrible convulsions, the eyes appeared bursting from their sockets, its mouth opened, and while performing an act, which we cannot describe without the risk of offending the delicacy of some of our readers, — oh ! most horrible to relate, one of its eyes leaped from its socket! and its two cheeks burst in twain ! ! The most appalling groans escaped from the justly incensed populace, which were followed by hisses and execrations. Cramp began to think he was carrying the joke too far, and tearing off the garments of the supposed infant, which consisted of a napkin, skilfully twisted round his arm, he exposed to view a large lemon, to which he had artfully given the semblance of a human face, by stripping the peel, and putting two black circles of ink on the white pith beneath, to resemble the eyes; by nipping up another portion to represent the nose, and by cutting out the lips, and forming a communication through the mouth with the interior of the lemon. No sooner was the trick exposed, than the indignation of the crowd was exchanged for tumultuous applause.

"Here is the baby's eye," exclaimed a villager, as he held up a pip of the lemon; a disclosure which was greeted by roars of reiterated laughter; and Giles Gingerly, and his man Jonathan, drove off in triumph, amidst the hearty cheers of the delighted multitude.

Should any of our readers question the possibility of producing so singular and perfect an illusion, by means of a lemon, we have only to request that they will repeat the experiment, and we feel satisfied they will consider that our description has actually fallen short, and failed in conveying an adequate idea of the ludicrous appearance which may be thus represented.

The company now hastened to the spot where the several sports were to take place, and to which they were directed by the sound of a bugle.

We have stated that a small enclosure had been prepared for the youths of the village, who were to perform the "*ludus Trojæ*," or Troy game. The major and his party had taken possession of the seat, placed for their accommodation under an awning; and the boys classically dressed, and furnished with little arms and weapons, were mustered in the *circo*. Each youth was mounted on a pony; and the troop having rode round the ring, and surveyed the spectators, the vicar arose from his seat, and, like the sage Epytides, gave the signal of attack by a crack of the whip. They now arranged themselves in two battalions, and hurling their javelins with an air of proud defiance, wheeled and charged, and urged the sportive war; at the conclusion of the game, the vicar called the principal youth, or "*princeps juventutis*," and presented him with a basket of fruit, which he desired him to divide amongst his companions.

The populace now separated into different groups; one party proceeded to witness a wrestling-match; another to see the foot-race; a third to be present at a match of quoits; for the vicar had provided all these games, in imitation of the ancient *Penthalum*, or *Quinquertium*. While observing the game of quoits, the vicar displayed much classical erudition; he said that Homer had represented Ajax and Ulysses as greatly skilled in the sport; and that Ovid, when he brings in Apollo and Hyacinth playing at it, had given a very elegant description of the exercise.* Scaliger, he continued, is of opinion, that the throwing the *discus*, or quoit, is but an improvement of the old sport of casting the sheep-hook; a conjecture, which, the vicar thought, received some support from a passage in the fourth Iliad.

" Mr. Twaddleton," cried Mr. Seymour, " you look at every sport with the eye of a classic or antiquary; I, on the other hand, as you well know, cautiously examine every action, to discover whether some scientific principle may not find an illustration. On the present occasion, I am desirous of directing the attention of the children to the manner in which yonder skilful player hurls his quoit."

" I do not exactly comprehend the object they have in view in throwing the quoits," said Louisa.

" Do you not perceive that two iron pins, or *hobs*, are driven into the ground, at the distance of eighteen or twenty yards asunder?" asked her father.

" To be sure, and I suppose that each player attempts to hit one of those pins."

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* Ovid's Metamorphoses, 10.

"The players stand at one of the *hobs*, and throw an equal number of quoits at the other; the nearest of them to the hob are reckoned towards the game. When they have cast all their quoits, the candidates go over to the point at which they have been throwing, and when they have determined the state of the game, they throw their quoits back again at the hob where they had before stood; and thus continue to act, on alternate sides, till the game is ended."

"I now understand it," cried Louisa.

"You doubtless know, Mr. Twaddleton," said Mr. Seymour, "that the casting of stones, darts, and other missiles, was among the amusements practised in the twelfth century by the young Londoners."

"*Casting of the bar*," replied the vicar, "was formerly a part of a hero's education; and kings and princes were admired for their agility and grace in throwing 'the stone, the bar, and the plummet.' Henry the Eighth, even after his accession to the throne, retained the casting of the bar among his favourite amusements. The sledge-hammer, and, among rustics, an axle-tree, were also used for the same purpose as the bar and the stone."

"The game of quoits is certainly far superior to such pastimes," said Mr. Seymour, " on account of its depending less on mere strength, and more upon superior skill."

" Did not you say, papa, that its action would illustrate some principle of science? I have been looking at the quoit, which I perceive is a circular piece of iron with a hole in the middle, but I cannot discover in what manner any scientific principle can be connected with its motion."

" If you will attentively observe a skilful player, you will perceive that he steadies the flight of the quoit, by imparting to it a spinning motion; were he not thus to *rifle* it, you would find that it would fly very far from the mark."

" Upon the same principle, I suppose, that we impart to the ball a spinning motion* at the game of *bilboquet?*"

" Precisely so," replied her father.

The "*penthalum*" having been concluded, the populace retired into several booths which were appropriated to refreshments. The shows now recommenced; those not already described were principally devoted to the exhibition of wild animals, an entertainment which the vicar considered as sanctioned by the highest classical authority; although he, at once, rejected a proposition made by the major, to render the amusement still more in accordance with ancient custom, by encouraging a fight between a lion and a tiger.

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* See Vol. I. p. 225.

The hour had now arrived for the grand banquet; and, by the command of the major, the band paraded the fair, playing the inviting tune of "Oh, the roast beef of old England." The populace hastened to the tent, and each took his place according to the number upon his ticket. It so happened, that Dr. Doseall found himself seated between Ned Hopkins and Giles Gingerly; and when we consider the cutting wit of the one, and the hostile calling of the other, we can readily imagine that the poor doctor considered his seat as any thing rather than a velvet cushion.

"I suppose the doctor will open upon us presently," observed Giles; "at present, he is as close as an oyster."

"Roast him," whispered Ned; "depend upon it, there is no better way of opening an oyster."

This exposed a very pretty prospect for poor Doseall, and he thought the wisest plan was to bolt, and take his chance of discovering some other seat; luckily, the major and his party were advancing to their places, at the very moment the doctor was retiring from the booth, and an explanation led the way to an invitation to the upper table.

We shall not detain our readers by an account of the dinner; it will be sufficient to state, in the language generally used upon such occasions, that the whole went off with great eclat, and gave universal satisfaction to the delighted guests.

The reader must now be contented to retire from the scene of frolic, and leave the villagers to the undisturbed enjoyment of their jollity. The major and his party returned to the house, where they remained until the hour approached at which the fire-works were to be discharged, and the festivities of the day concluded.

Mr. Seymour accompanied his children to the stage, erected for the pyrotechnic exhibition, in order that he might explain the construction of the fire-works before they witnessed them in action.

"Upon my word, the major has provided most liberally for our entertainment!" exclaimed Mr. Seymour, as he ascended the steps which led to the platform. “I declare there is a forest of *rockets!* and what magnificent *Pin-wheels, Tourbillions, Marroons, Pots des Aigrettes, Gerbes, Courantins,* and *Roman Candles.*”

“Are those paper cylinders, with long sticks, rockets?” enquired Tom.

“They are; and if you will attend to me, I will explain the principle of their construction. They have ever been considered as holding the first place amongst single fire-works, and deservedly so; not only on account of the splendid appearance they present when fired by themselves, but from their extensive application in increasing the beauty of other exhibitions. The rocket, you perceive, consists of a strong paper cylinder, which is filled with a suitable composition; it is crowned with a head, or ‘*pot,*’ as it is technically termed, charged with various materials, which throw out sparks, stars, and other decorations, as soon as it takes fire in the air, after the body of the rocket has been consumed. You may observe that the head is made to terminate in a point, which greatly facilitates its passage through the air. The whole is affixed to a straight stick, which, like the rudder of a ship, makes it turn towards that side to which it is inclined, and consequently causes the rocket to ascend in a straight line."

"But, papa," observed Louisa, "all the rockets have not straight rods; see, there is one with a crooked stick."

"That is for the purpose of causing the rocket to ascend in the form of a screw: the first effect of the bent rod will be to make the rocket incline towards that side to which it is bent; but its centre of gravity bringing it afterwards into a vertical situation, the result of these two opposite efforts will be, that the rocket will ascend in a zig-zag or spiral form. In this case, however, since it displaces a greater volume of air, and describes a longer line, it will not ascend so high as if it had been impelled in a straight direction; but I think you will admit that, on account of the singularity of this motion, it produces a very agreeable effect."

"And what causes the rocket to ascend into the air?" asked Tom.

"That is a question much more readily asked than answered," replied Mr. Seymour: "it is a subject which has engaged the attention of several most distinguished philosophers. I shall first describe to you the theory of Desaguliers. He says, ‘Let us suppose that the interior of the rocket were inflamed, and that there were not any vent for the fire; the consequence would be, either that the rocket would burst in the weakest part; or, if all the parts were equally strong, and able to sustain the impulse of the fire, that the rocket would burn out without any motion. Now, as the force is equal in all directions, suppose its action downwards, or that upwards, sufficient to lift forty pounds; as these forces are equal, but their directions contrary, they will destroy each other's action. In the next place, imagine the rocket opened at the choak; in consequence of which the action of the flame downwards is taken away, and there remains a force equal to forty pounds acting upwards, to carry up the rocket, and the stick or rod to which it is attached. We accordingly find that if the composition of the rocket be very weak, so as not to give an impulse greater than the weight of the rocket and its stick, it does not rise at all; or if the composition be slow, so that a small part of it only kindles at first, the rocket will not rise.’ Dr. Hutton explains the phenomenon in somewhat different a manner. He says, 'that at the moment when the powder begins to inflame, its expansion produces a torrent of elastic fluid, which acts in every direction; that is, against the air which opposes its escape from the cartridge, and against the upper part of the rocket; but the resistance of the air is more considerable than the weight of the rocket, on account of the extreme rapidity with which the elastic fluid issues through the neck of the rocket to throw itself downwards, and therefore the rocket ascends by the excess of the one of these forces over the other.' "

Tom observed, that he thought Dr. Hutton's explanation more simple and plausible, than that of Desaguliers.

" Dr. Hutton adds," continued Mr. Seymour, " that the rocket could not rise unless a sufficient quantity of elastic fluid were produced, and hence arose the expedient of piercing the rocket with a conical hole, so as to make the composition burn in conical strata, which, having much greater surface, produce a much greater quantity of inflamed matter and elastic fluid. Without such a contrivance, the composition would inflame only in circular coats of a diameter equal to that of the rocket; and experience has shown that this is not sufficient for the purpose."

"What are those fire-works, attached to the lines?" asked Tom.

"Those, my dear, are line-rockets, or *courantines*[*], and which, instead of rising into the air, run along the line, to which they are attached by means of a hollow cylinder. Their motion is to be explained upon the same principle as that of the sky-rocket; a force is generated by the escape of elastic matter, and as the rocket is confined to the rope, it is made to run along the line, instead of ascending into the air."

"That is clear enough," said Louisa; "but see, papa, there is the figure of a dragon on yonder rope!"

"That is merely a runner for the courantine, which is constructed in that form, for the purpose of rendering the exhibition more surprising. I dare say it is filled with various compositions, such as golden rain, and fires of different colours, which will greatly heighten the effect; indeed this pyrotechnic amusement may be infinitely varied."

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[*] From the French term *courant*, signifying running.

"Are not those *pin-wheels*, which are elevated above the railing?" said Tom.

"Yes; they are pin or Catharine wheels, and if you will look at them, you will perceive that they are of very simple construction; consisting merely of a long paper tube, filled with inflammable matter, and rolled round a small circle of wood, so as to form a helix or spiral line."

"The circle of wood, I suppose, is pierced in the middle for the purpose of receiving a pin, by which the wheel is attached to the post," said Tom.

"Exactly so; and the cause of their revolution is the same as that which produces the flight of the rocket; the impulse of the air forces back the ignited part of the wheel, which generates, as it were, a centrifugal force, while the attachment of the pipe, by preventing its obeying such a force, may be said to represent the centripetal force, and thus is the revolution of the wheel continued, until the whole of the composition is consumed."

"I think you told us, when speaking of the thaumatrope*, it was the rapidity with which the flame revolved, that occasioned the star-like appearance which is exhibited by this fire-work," observed Louisa.

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* See the present volume, p. 15.

"Undoubtedly, my dear, it cannot be otherwise."

The party now examined the remaining specimens of the pyrotechnic art. Mr. Seymour informed them that *marroons* were nothing more than small cubical boxes, filled with a composition proper for making them burst, and thence producing a loud report. He said that they were principally used in combination with other pieces, or to form a battery, in which, by different lengths of quick match, they were made to explode at distinct intervals. Mr. Seymour added, that when the cases were made cylindrical, instead of being cubical, they exchanged the name of marroon for that of *saucisson*. Louisa enquired the nature of certain cylindrical cases she observed on the stage, and was informed that they were *gerbes*, a species of fire-work, which throws up a luminous and sparkling jet of fire, and from a supposed resemblance to a water-spout, has derived the appellation of *gerbe*. Mr. Seymour next pointed out to Tom a row of *Roman candles*, some of which were fixed quite perpendicular, others inclining at different angles, so that the balls might be projected to various distances, and thus produce a more varied effect. He observed, that, to his taste, it was by far the most beautiful fire-work ever exhibited.

"I am quite impatient for the exhibition," cried Tom; "pray, papa, what is the hour? I think it was determined to let them off at ten o'clock."

"It is now about eight o'clock; we will, therefore, return to the house: we shall, however, I suspect, have a curious sight to witness in our way through the fair; for by this time every booth is illuminated."

The scene was indescribably beautiful, and might be said to resemble an enchanted island. The trees were lighted up with an endless profusion of Chinese lanterns, of various colours, and decorated with fantastic transparencies, which produced an effect highly graceful and pleasing. The booths were richly studded with lights; and, near the platform, on which the villagers were enjoying the country dance, was erected a pyramid, which blazed with several hundred variegated lamps.

At ten o'clock the commencement of the fireworks was announced by a shower of rockets. The music ceased; and the dancers, together with the spectators which had gathered around the platform, hastened to the spot, whither they were summoned by the sound of trumpets, to witness the pyrotechnic entertainment which was to crown the festivities of the day.

The little Seymours had been stationed by their father in the most favourable spot for seeing the exhibition; and highly were the major and his party delighted with the observations which fell from the intelligent children on the occasion.

"Observe, Louisa, the rocket as it ascends describes a parabola," cried Tom.

"Oh, how extremely beautiful! see the head has burst, and is discharging a number of brilliant stars! What is that red spark which is now falling to the ground, papa?"

"That is the ignited stick of the rocket," replied his father.

"Take care, Louisa, do not hold your face up," exclaimed Tom; "for as the rocket bursts over our heads, the stick may fall upon us."

"I scarcely expected such an observation from you, Tom," said his father, "after the sensible remark you just made respecting the parabolic path of the rocket; do not you remember that when a projectile has reached its greatest altitude it will descend in a curve similar to that in which it ascended."

"True, true," answered Tom, "I see my error; the stick must, of course, fall at a considerable distance from us."

"Look! look!! There goes a *courantine:* how it ran along the rope!" exclaimed Louisa.

"There goes another!" cried Tom, "and see, it is the dragon; and, I declare, there is another running in an opposite direction; — they meet. Look at the serpents which they discharge from their mouths. Now they return to the extremity of the line with great violence. What an explosion!!!"

In like manner were next exhibited two ships, which, being filled with serpents, were made to pour their broadsides at each other.

"I never saw better courantines in my life," said Mr. Seymour; "the major really conducts the exhibition with great skill; it does him infinite credit as an engineer."

Another shower of rockets succeeded, and the air resounded with the applause of the populace.

(Bang) — (bang) — (bang) —

"There go the marroons," said Mr. Seymour.

The band now struck up a march, and the major completely succeeded, by having arranged different lengths of quick match, in making them explode at appropriate intervals, so as to mark correctly, the commencement of each bar of the music which was performing.

"Bravo! bravo!" exclaimed Mr. Seymour; "had Handel witnessed such an effect, he would have engaged the major as a performer in his grand choruses."

"See! what a beautiful fountain of fire — there! now a most brilliant star is ejected!"—

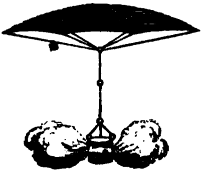
"It is a Roman candle," said Mr. Seymour.

A variety of different rockets were next exploded; such as "*Towering* rockets," so called from their ascending to a greater height than any others; an effect which is produced by fixing a smaller rocket on the top of another of superior dimensions: "*Honorary* rockets," which, when they attain their greatest height, communicate fire to other rockets affixed to them in a transverse direction, and thus produce a rapid revolution, and represent, on their return to the ground, a spiral of descending fire: "*Caduceus* rockets," so called from their resemblance, when in action, to the rod borne by Mercury; the effect is produced by firing two rockets obliquely on the opposite sides of a rod, so that they shall form, in their flight, two spiral lines.

It is not necessary to enumerate the series of beautiful exhibitions which succeeded; we shall only add, that the concluding fire-work was a Catharine-wheel of imposing splendour. After having repeatedly changed its device, during its revolution, it at length exploded and threw out a group of serpents; the dense volume of smoke which followed this explosion, having gradually cleared off, the appropriate motto of "FAREWELL," appeared in brilliant letters of fire.

In a few minutes the populace began to separate; they had, however, scarcely arrived at the gate of the park, when a large rocket ascended, and bursting over their heads, discharged a parachute, to which was attached a brilliant light; eight similar rockets were successively fired, and with the same effect. The major had ingeniously contrived, by varying the angle, to disengage the floating luminaries in the form of a crown or circle, which threw a most brilliant light over the whole country; nor did it fade, until sufficient time had been allowed for the return of the villagers to their respective homes.

Should our readers have fortunately been infected with a portion of that good humour and hilarity which elated the hearts of the rustic spectators upon this memorable occasion, we may conclude our labours with a conviction that they will receive a favourable reception at the tribunal of public opinion.



ADDITIONAL NOTES.

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REFERRED TO BY THE FIGURES IN

VOLUME I.

NOTE 1. p. 7.

THE HOROLOGE OF FLORA is alluded to by Pliny with his usual felicity of thought and expression. "Dedi tibi herbas horarum indices; et ut ne sole quidem oculos tuos a terra avoces, heliotropium ac lupinum circumaguntur cum illo. Cur etiam altius spectas, ipsumque cœlum scrutatis? Habes ante pedes tuos ecce Vergilias."—*Hist. Nat.* lib. xviii. c. 27.

Linnæus enumerates forty-six flowers which possess this kind of sensibility. The following are a few of them, with their respective hours of rising and setting, as the Swedish naturalist terms them. He divides them into *meteoric* flowers, which less accurately observe the hour of unfolding, but are expanded sooner or later, according to the cloudiness, moisture, or pressure of the atmosphere.

2d. *Tropical* flowers, which open in the morning, and close before evening every day; but the hour of the expanding becomes earlier or later, as the length of the day increases or decreases.

3d. *Equinoctial flowers*, which serve for the construction of Flora's dial, since they open at a certain and exact hour of the day, and for the most part close at another determinate hour: for instance, the *Leontodon Taraxacum*, dandelion, opens at 5–6, closes at 8–9; *Hieracium Pilosella*, mouse-ear hawkweed, opens at 8, closes at 2; *Tragopogon pratensis*, yellow goat's-beard, opens at sunrise, and shuts at noon with such regularity, that the husbandman who adopts it as the signal of dinner-time need not fear to have his pudding too much or too little boiled; *Sonchus lævis*, smooth sow-thistle, opens at 5, closes at 11–12; *Lactuca sativa*, cultivated lettuce, opens at 7, closes at 10; *Tragopogon luteum*, yellow goat's-beard, opens at 3–5, closes at 9–10; *Lapsana*, nipplewort, opens at 5–6, closes at 10–11; *Nymphæa alba*, white water-lily, opens at 7, closes at 5; *Papaver nudicaule*, naked poppy, opens at 5, closes at 7; *Hemerocallis fulva*, tawny day-lily, opens at 5, closes at 7–8; *Convolvulus*, opens at 5–6; *Malva*, mallow, opens at 9–10, closes at 1; *Arenaria purpurea*, purple sandwort, opens at 9–10, closes at 2–3; *Anagallis*, pimpernel, opens at 7–8; *Portulaca hortensis*, garden purslain, opens at 9–10, closes at 11–12; *Dianthus prolifer*, proliferous pink, opens at 8, closes at 1; *Cichoreum*, succory, opens at 4–5; *Hypocharis*, opens at 6–7, closes at 4–5; *Crepis*, opens at 4–5, closes at 10–11; *Picris*, opens at 4–5, closes at 12; *Calendula Africana*, opens at 7, closes at 3–4, &c.

> "Thus in each flower and simple bell,
> That in our path betrodden lie,
> Are sweet remembrancers who tell
> How fast the winged moments fly."

NOTE 2. p. 68.

It may, perhaps, be asked, how this decrease of weight could have been ascertained; since, if the body under examination decreased in weight, the weight which was opposed to it in the opposite scale must also have diminished in the same proportion; for instance, that if the lump of lead lost two pounds, the body which served to balance it must also have lost the same weight, and therefore that the different force of gravity could not be detected by such means. It is undoubtedly true that the experiment in question could not have been performed with an ordinary pair of scales, but by using a spiral spring it was easy to compare the force of the lead's gravity at the surface of the earth, and at four miles high, by the relative degree of compression which it sustained in those different situations. We may take this opportunity of observing, that as the force of gravity varies directly as the mass, or quantity of matter, a body weighing a pound on our earth would, if transferred to the sun, weigh $27\frac{3}{4}$ pounds; if to Jupiter, $3\frac{1}{10}$ lbs.; if to Saturn, $1\frac{1}{9}$; but, if to the moon, not more than three ounces.

NOTE 3. p. 74.

In order to perform this experiment with the highest degree of accuracy, a body of considerable specific gravity should be selected, such as lead or iron; for a common stone experiences a considerable retardation in falling, from the action of the air. Where the arrival of the body at the bottom of the cavern to be measured cannot be *seen*, we must make allowance in our calculation for the known velocity of sound; thus, suppose a body were ascertained to fall in five seconds. As a heavy body near the earth's surface falls about 16$\frac{1}{12}$ feet in one second of time, or for this purpose 16 feet will be sufficiently exact; and as sound travels at the rate of 1142 feet per second, multiply together 1142, 16 and 5, which will give 91360, and to four times this product, or 365440, add the square of 1142, which is 1304164, and the sum will be 1669604; then if from the square root of the last number = 1292 the number 1142 be subtracted, the remainder 150 divided by 32 will give 4·69 for the number of seconds which elapsed during the fall of the body; if this remainder be subtracted from 5, the number of seconds during which the body was falling and the sound returning, we shall have 0·31 for the time which the sound alone employed before it reached the ear; and this number multiplied by 1142, will give for product 354 feet, equal the depth of the well. This rule, which, it must be allowed, is rather complex, is founded on the property of falling bodies, which are accelerated in the ratio of the times, so that the spaces passed over increase in the square of the times.

The following is a more simple but less accurate rule. Multiply 1142 by 5, which gives 5710; then multiply also 16 by 5, which gives 80, to which add 1142, this gives 1222, by which sum divide the first product 5710, and the quotient 4·68 will be the time of descent, nearly the same as before. This taken from 5, leaves 0·32 for the time of the ascent; which, multiplied by 1142, gives 365 for the depth, differing but little from the former more exact number.

NOTE 4. p. 78.

This superstition still prevails in many parts of England, especially in Cornwall, where the peasants on certain days of the year assemble at the springs, or holy wells, and in the manner stated in the text, proceed to settle such doubts and enquiries as will not let the idle and anxious rest. Here, therefore, they come, and, instead of allaying, deservedly feed their uneasiness; the supposed responses serving equally to increase the gloom of the low-spirited, the suspicions of the jealous, and the passion of the enamoured. The superstition, however, is sanctioned by the highest antiquity. The Castalian fountain, and many others among the Grecians, was supposed to be of a prophetic nature. By dipping a fair mirror into a well, the Patræans of Greece received, as they supposed, some notice of ensuing sickness or health, from the various figures portrayed upon the surface. In Laconia they cast into a pool, sacred to Juno, cakes of bread-corn; if they sank, good was portended; if they swam, something dreadful was to ensue. Sometimes they threw three stones into the water, and formed their conclusions from the several turns they made in sinking. "From the several waves and eddies, which the sea, river, or other water exhibited," says Dr. Borlase, "when put into agitation after a ritual manner, the ancients pretended to foretel with great certainty the event of battles; a way of divining recorded by Plutarch, in his life of Cæsar, and is still usual among the vulgar in Cornwall; who go to some noted well, at particular times of the year, and there observe the bubbles that rise, and the aptness of the water to be troubled, or to remain pure, on their throwing in pins or pebbles, and thence conjecture what shall, or shall not befall them. The Druids also, as we have great reason to think, pretended to predict future events, not only from holy wells, and running streams, but from the rain and snow water, which, when settled, and afterwards stirred, either by oak-leaf or branch, or magic wand, might exhibit appearances of great information to the quick-sighted Druid, or seem so to do to the credulous enquirer, when the priest was at full liberty to represent the appearances as he thought most for his purpose." — BORLASE's *Antiquities of Cornwall*, p. 140.

NOTE 5. p. 94.

The Latin word *moneta*, for money, is probably more modern than *pecunia*, and is said to be derived from *moneo*, to advise or mark, that is, to show by some mark the weight and fineness of the metal of which coins were composed. Thus, according to Isidorus, " Moneta ita appellatur, quia monet nè qua fraus in pondere vel metallo fiat." The origin of money seems to have been coeval with the first regulations of civil society, or, at least, it is too remote to be traced by any authentic history. Barter, that is the exchange of one commodity for another, was the ordinary mode of traffic in the earlier periods of the world; a practice which must soon have been discovered extremely inconvenient, and inadequate to the purposes of commerce, and hence the invention of a common measure, or standard, according to which all other things should be estimated. Writers very generally agree in believing that the metals were first used for such a purpose, as being almost the only substances, whose goodness, and, as it were integrity, were not injured by partition; and which admitted of being melted, and returned again into a mass of any size or weight. At first, it is probable, that each person cut his metal into pieces of different sizes and forms, according to the quantity to be given for any merchandize, or according to the demand of the seller, or the quantity stipulated between them; to this end they went to market, laden with metal, in proportion to the purchase to be made, and furnished with instruments for apportioning it, and with scales for dealing it out, according as occasion required. By degrees it must have been found commodious to have pieces ready weighed; and Mr. Pinkerton observes that such were prepared without any stated form or impression, but merely regulated to a certain weight; for *weight* was the grand standard of ancient coinage, so that all large sums were paid in weight, even down to the Saxon period of England. As in Greece the first estimation of money was merely by weight, so was it in Rome. Silver was the metal first used in Grecian coinage, but copper in the Roman; the former metal having been long unknown to the Romans. The first valuation of Roman money was by the *libra gravis æris*, or pound of heavy brass; and when by the progress of their conquests they obtained silver and gold, these were regulated in the same manner. Let us proceed one step farther in the history of coins; it is easy to imagine that the growing commerce of money being disturbed with frauds, both in the weight and the material, the interposition of public authority became necessary, and that hence arose the first stamps or impressions of money; to which succeeded the names of the moneyers, and at length the effigy of the prince, the date, legend, and other precautions to prevent the alteration of the species; and thus were coins completed. Gold and silver, in their pure or unmixed state, are too flexible to make coins sufficiently firm for general use; and hence the necessity of mixing with them a certain proportion of some harder metal, and this mixture is called the *alloy*. The quality of this alloy has been always considered of great importance with respect to the durability of coins. The most common metal, used for this purpose, is copper; and sometimes, for gold, a mixture of silver and copper. In all well-regulated governments, there has been a standard fixed by law; that is, a certain proportion between the quantity of pure metal and its alloy. In England the standard for gold is $\frac{11}{12}$, that is eleven parts of pure metal, and one part of alloy. The standard for silver is $\frac{37}{40}$, a proportion which is said to have been fixed in the reign of Richard I., by certain persons from the eastern parts of Germany, called *Easterlings;* and hence the word *Sterling*, which was afterwards the name given to the silver penny, and which is now applied to all lawful money of Great Britain.

By the term MEDAL, we understand a piece of metal, in the form of a coin, destined to preserve to posterity the portrait of some great man, or the memory of some illustrious action. They are distinguished by their different sizes; those of the larger size, or volume, are called *medallions*. *Medallets* is a name given by Pinkerton to those small pieces, or *missilia*, scattered among the people on solemn occasions; those struck for the slaves in the Saturnalia, private counters for gaming, tickets for baths and feasts, tokens in copper and lead, and the like. Medallions were certainly never intended to become current coin, as some medals probably were; they were struck purely to serve as public monuments, or to be presented by the emperor to his friends, and by the mint-makers to the emperor, as specimens of fine workmanship. They were struck upon the commencement of the reign of a new emperor, and other solemn occasions; and frequently, especially the Greek medallions, as monuments of gratitude, or of flattery. Sometimes they were trial or pattern pieces, *testimonia probatæ monetæ;* and such abound after the reign of Maximilian, with the "Tres monetæ" on the reverse. It is observed, that all the Roman pieces in gold, exceeding the *denarius aureus;* all in silver, superior to the *denarius;* and all in brass, superior to the *sestertius*, or what the medallist terms large brass, are comprehended under the description of medallions. Mr. Pinkerton, however, thinks that the gold medallions, weighing two, three, or four aurei only, passed in currency according to their size. Medallions from the time of Julius to that of Adrian, are very uncommon, and of very high price; from Adrian to the close of the western empire they are, generally speaking, less rare. The types of the Roman medallions are often repeated upon common coin; hence they appear of less importance than the Greek; impressions of which are frequently most uncommon, and no where else to be found. Many Roman medallions have S. C., as being struck by order of the senate; those without these initials, were struck by order of the emperor. Of Augustus, a noble medallion was found in Herculaneum. There are medallions of Augustus and Tiberius, struck in Spain; and one of Livia, at Patræ in Achaia. One in brass, of Antony and Cleopatra; reverse, two figures in a car, drawn by sea-horses. Of Tiberius there are many; and also of Claudius, Agrippina, Nero, Galba, Vespasian, and Domitian, &c. The Greek medallions of Roman emperors are far more numerous than the Roman; with a few exceptions, however, all medallions are rare and of princely purchase. Even in the richest cabinet, twenty or thirty specimens are esteemed a respectable proportion.

The parts of a medal are the two sides, one whereof is called the *face*, *head*, or obverse; the other the *reverse.* On each side is the *area*, or *field;* the *rim*, or *border;* and the *exergum*, which is beneath the ground, whereon the figures represented are placed. On the two sides are distinguished the *type*, and the *inscription*, or *legend.* The type, or device, is the figure represented; the legend is the writing, especially that around the medal; though in the Greek medals the inscription is frequently on the area. What we find in the exergum is, generally, no more than some initial letters, whose meaning we are usually unacquainted with; though, sometimes, they contain words that may be accounted an inscription.

The exergum sometimes contains the date of the coin, expressing in what consulship of the emperor it was struck, as Cos. III., upon the reverse of an Antoninus. Sometimes it signifies the place where it was struck, and to which the coin properly belonged, as S. M. AL. for *Signa Moneta Alexandriæ*, upon the reverse of a Licinius. Sometimes the name of a province, the reduction of which the medal is designed to celebrate; as Judæa on the reverse of a Vespasian.

We have stated that medals are of great importance to the study of history. They, indeed, furnish the principal proof of historic truth, as their evidence reaches to the most remote ages, as well as to the most remote countries. Vaillant, in his learned history of the Syrian kings, printed at Paris, 1681, first fixed the dates, and arranged the order of events in ancient historians, by means of these infallible vouchers. Thus he was enabled to ascertain the chronology and progress of events of three of the most important kingdoms of the ancient world; viz. those of Egypt, of Syria, and of Parthia. The study of the Roman medals has, in this respect, an advantage over that of Greek coins, since they serve not only to illustrate the chronology of reigns, but to aid us in the interpretation of particular events. To this purpose, besides the portrait of the prince, and date of his consulship, or of his tribunitian power, we have a representation, or poetical symbol, of some grand event on the reverse. In a word, the series of Roman coins presents the very best suite of documents relating to the Roman History. In addition to its historical importance, the medal is frequently a useful guide to geography, natural history, architecture, ancient monuments, busts, statues, ceremonies, and the like. See Addison's *Dialogues on the Usefulness of Ancient Medals.* On this subject, also, Pinkerton, in his valuable work on medals, has some interesting remarks; he says that, to a man of poetical imagination, the Roman coins must prove an ample source of intellectual delight, by means of the fine personifications and symbols which are to be found on their reverse. *Happiness* has sometimes the caduceus, or wand of Mercury, which Cicero tells us was thought to procure the gratification of every wish. In a gold coin of Severus, she has heads of poppy to express that our prime bliss lies in oblivion of misfortune. *Hope* is represented as a sprightly damsel, walking quickly and looking straight forward. With her left hand she holds up her garments, that they may not hinder the rapidity of her pace; while, in her right hand, she holds forth the bud of a flower, an emblem infinitely more beautiful than the trite one of an anchor, which is the symbol of Patience, not of Hope. *Abundance* is imaged as a sedate matron, with a cornucopia in her hands, of which she scatters the fruits over the ground; but does not hold it up, and keep its contents to herself, as many poets and painters have represented her. *Security* stands leaning on a pillar, indicative of her being free from all designs and pursuits; and the posture itself corresponds to her name.

Coins also present us with countries and rivers admirably personified. On the reverse of a colonial coin, rude in execution, of Augustus and Agrippa, inscribed IMP. and DIVI. F., the conquest of Egypt is represented by the apposite metaphor of the crocodile, an animal almost peculiar to that country, and at that period esteemed altogether so, which is chained to a palm tree, at once a native of the country, and symbolic of victory. Moreover, a cabinet of medals, of which Rubens is said to have possessed a very magnificent one, may be considered as forming the classic erudition of a painter. We may add, that almost all the uses which connect the science of medals with painting, render it also subservient to the art of the sculptor, who cannot less than profit by the study of the Greek coins in particular. The connection of the study of ancient coins with architecture, consists in the views of many of the ancient edifices, which are found in perfect preservation on medals. Froelich observes, that the coins of Tarsus are very remarkable for a kind of perspective in the figures. On others are found triumphal arches, temples, fountains, aqueducts, amphitheatres, circuses, palaces, columns, obelisks, baths, sea-ports, pharoses, and the like.

The study of medals affords such a variety of amusement and of instruction, that we may naturally suppose it to be nearly as ancient as medals themselves; and yet ancient writers do not furnish us with a single hint of collections of this kind. In the days of Greece, a collection of such coins as then existed would not be regarded as an acquisition of any great value, because it must have consisted only of those that were struck by the innumerable little states which then used the Greek characters and language, and of course it would be considered as a kind of domestic coinage, precluded from extension by the narrow limits of the intercourse that subsisted between different provinces and countries. As soon as any communication was opened between the Romans and the Greeks, the Grecian coins were imitated by the Roman workmen, and preserved in the cabinets of their senators among the choicest treasures. In a more advanced period of the Roman empire, individuals must have formed collections of Roman coins; for we find that a complete series of silver was lately found in our island, containing inclusively, all the emperors down to Carausius. From the decline of the Roman empire, most branches of science were enveloped in darkness, till the revival of letters towards the end of the fifteenth century. When literature began to be cultivated in Italy, the study of medals, connected with that of ancient erudition, began to engage attention. Accordingly Petrarch, who in modern times was amongst the first persons in Europe that aspired to the celebrity of learning and genius, was likewise the first to revive the study of medals. This eminent man, having been desired by the Emperor Charles V. to compose a book that should contain a history of the coins of illustrious men, and to place him in the list, is said to have returned for answer, that he would comply with his desire, whenever the Emperor's future life and actions deserved it. Availing himself of this circumstance, he sent that monarch a collection of gold and silver coins of celebrated men. "Behold!" said he, "to what men you have succeeded! Behold whom you should imitate and admire! To whose very form and image you should compose your talents! The invaluable present I should have given to no one but yourself; it was due to you alone. I can only know or describe the deeds of these great men: your supreme office enables you to imitate them." In the next age, Alphonso, king of Arragon, caused all the ancient coins that could be discovered throughout the provinces of Italy to be collected, which he placed in an ivory cabinet, and always carried about with him, that he might be excited to great actions by the presence, as it were, of so many illustrious men in their images.

To those who are desirous of gaining information upon this interesting branch of antiquarian research, we strongly recommend Mr. Pinkerton's *Essay on Medals.*

NOTE 6. p. 119.

Mechanical powers are simple arrangements by which we gain power at the expense of time; thus, if a certain weight can be raised to a certain height by unassisted strength, and the same thing is afterwards done with one tenth part of the exertion, through the use of a mechanic power, it will be found to occupy ten times as much time. In many cases, however, loss of time is not to be put in competition with the ability to do a thing; and since the advantages which the mechanical powers afford to man, by enabling him to perform feats which, without their assistance, would have been for ever beyond his reach, are incalculably great, the waste of time is overlooked, and is much more than balanced in the general result. It is true that, if there are several small weights, manageable by human strength, to be raised to a certain height, it may be full as convenient to elevate them one by one, as to take the advantage of the mechanical powers in raising them all at once; because the same time will be necessary in both cases: but suppose we should have an enormous block of stone, or a great tree to raise; bodies of this description cannot be separated into parts proportionable to the human strength, without immense labour, nor, perhaps, without rendering them unfit for those purposes to which they are to be applied; hence then the great importance of the mechanical powers, by the use of which a man is able to manage with ease a weight many times greater than himself.

To understand the principle of a mechanical power, we must revert to the doctrine of momentum. It will be remembered, that a small ball, weighing only two pounds, and moving at the rate of 500 feet in a second, will produce as much effect as a cannon ball of ten pounds in weight, provided it only moved at the rate of 100 feet in the same time; in like manner a ball weighing one pound may be made to balance another of five pounds, by placing it five times farther from the centre of motion; for in such a case, for every inch of space through which the large ball passes, the small one will traverse five inches, and will thus generate five times the momentum. This may be rendered still more evident by turning to page 273., where the *see-saw* is described, which, in fact, is a true mechanical power. It will be at once evident, from an inspection of the figure, that the lesser boy will pass over a much greater space, in equal time, than the greater boy, and thus generate more momentum, which compensates for his defect in weight, and renders him a balance for his heavier companion. It is curious to reflect upon what a simple, and apparently trivial truth the mechanical powers are founded, viz. that the lengths of circles are in proportion to their diameters; for it is an immediate consequence of this property of the circle, that if a rod of iron, or beam of wood, be placed on a point or pivot, so that it may move, as a see-saw board does, round its prop, the two ends will go through parts of circles, each proportioned to that arm of the beam to which it belongs; the two circles will be equal if the pivot is in the centre or middle point of the beam; but if it is nearer one end than the other, say five times, that end will pass through a circular space, or arc, five times shorter than the circular space the other end goes through in the same time. If, then, the end of the long beam goes through five times the space, it must move with five times the swiftness of the short end, since both move in the same time; and, therefore, any force applied to the long end must overcome the resistance of five times that force applied at the opposite end, since the two ends move in contrary directions; hence one pound placed at the long end would balance five placed at the short end. The beam we have been describing constitutes the first of the mechanical powers, and is termed the LEVER. There are, besides five others, viz. the *wheel and axle;* the *inclined plane;* the *screw;* the *pulley;* and the *wedge;* out of the whole, or a part of which, it will be found that every mechanical engine or piece of machinery is constructed.

THE LEVER being the simplest of all the mechanic powers, is in general considered the first. It is an inflexible rod or bar of any kind, so disposed as to turn on a pivot or prop, which is always called its *fulcrum.* It has the weight or resistance to be overcome attached to some one part of its length, and the power which is to overcome that resistance applied to another; and, since the *power*, *resistance*, and *fulcrum* admit of various positions with regard to each other, so is the lever divided into three kinds or modifications, distinguished as the first, second, and third kinds of lever. That portion of it which is contained between the fulcrum and the power, is called the acting part or arm of the lever; and that part which is between the fulcrum and resistance, its resisting part or arm.

In the lever of the first kind, the fulcrum is placed between the power and the resistance. A poker, in the act of stirring the fire, well illustrates this subject; the bar is the *fulcrum*, the hand the power, and the coals the resistance to be overcome. Another common application of this kind of lever is the crow-bar, or hand-spike, used for raising a large stone or weight. In all these cases, power is gained in proportion as the distance from the fulcrum to the power, or part where the men apply their strength, is greater than the distance from the fulcrum to that end under the stone or weight. A moment's reflection will show the rationale of this fact; for it is evident that if both the arms of the lever be equal, that is to say, if the fulcrum be midway between the power and weight, no advantage can be gained by it, because they pass over equal spaces in the same time; and, according to the fundamental principle already laid down, *as advantage or power is gained, time must be lost;* but, since no time is lost under such circumstances, there cannot be any power gained. If now, we suppose the fulcrum to be so removed towards the weight, as to make the acting arm of the lever three times the length of the resisting arm, we shall obtain a lever which gains power in the proportion of three to one, that is, a single pound-weight applied at the upper end will balance three pounds suspended at the other. A pair of scissors consists of two levers of this kind, united in one common fulcrum; thus the point at which the two levers are screwed together is the fulcrum; the handles to which the power of the fingers is applied, are the extremities of the acting part of the levers, and the cutting part of the scissors are the resisting parts of the levers; the longer, therefore, the handles, and the shorter the points of the scissors, the more easily you cut with them. A person who has any hard substance to cut, without any knowledge of the theory, diminishes as much as possible the length of the resisting arms, or cutting part of the scissors, by making use of that part of the instrument nearest the screw or rivet. Snuffers are levers of a similar description; so are most kind of pincers, the power of which consists in the resisting arm being very short in comparison with the acting one.

In the lever of the second kind, the resistance or weight is between the fulcrum and the power. Numberless instances of its application daily present themselves to our notice; amongst which may be enumerated the common cutting knife, used by last and patten makers, one end of which is fixed to the work-bench by a swivel-hook. Two men carrying a load between them, by one or more poles, as a sedan chair, or as brewers carrying a cask of beer, in which case either the back or front man may be considered as the fulcrum, and the other as the power. Every door which turns upon its hinges is a lever of this kind; the hinges may be considered as the fulcrum, or centre of motion, the whole door is the weight to be moved, and the power is applied to that side on which the handle is usually fixed. Nut-crackers, oars, rudders of ships, likewise fall under the same division. The boat is the weight to be moved, the water is the fulcrum, and the waterman at the oar is the power. The masts of ships are also levers of the second kind, for the bottom of the vessel is the fulcrum, the ship the weight, and the wind acting against the sail is the moving power. In this kind of lever the power or advantage is gained in proportion as the distance of the power is greater than the distance of the weight from the fulcrum; if, for instance, the weight hang at one inch from the fulcrum, and the power acts at five inches from it, the power gained is five to one; because, in such a case, the power passes over five times as great a space as the weight. It is thus evident why there is considerable difficulty in pushing open a heavy door, if the hand is applied to the part next the hinges, although it may be opened with the greatest ease in the usual method. In the third kind of lever, the fulcrum is again at one of the extremities, the weight or resistance at the other; and it is now the power which is applied between the fulcrum and resistance. As in this case the weight is farther from the centre of motion than the power, such a lever is never used, except in cases of absolute necessity, as in the case of lifting up a ladder perpendicularly, in order to place it against a wall. The man who raises it cannot place his hands on the upper part of the ladder; the power, therefore, is necessarily placed much nearer the fulcrum than the weight; for the hands are the power, the ground the fulcrum, and the upper part of the ladder the weight. The use of the common fire-tongs is another example, but the circumstance that principally gives this lever importance is, that the limbs of men and animals are actuated by it; for the bones are the levers, while the joints are the fulcra, and the muscles which give motion to the limbs, or produce the power, are inserted and act close to the joints, while the action is produced at the extremities; the consequence of such an arrangement is, that although the muscles must necessarily exert an enormous contractile force to produce great action at the extremities, yet a celerity of motion ensues which could not be equally well provided for in any other manner. We may adduce one example in illustration of this fact. In lifting a weight with the hand, the lower part of the arm becomes a lever of the third kind; the elbow is the fulcrum; the muscles of the fleshy part of the arm the power; and as these are nearer to the elbow than the hand, it is necessary that their power should exceed the weight to be raised. The disadvantage, however, with respect to power, is more than compensated by the convenience resulting from this structure of the arm; and it is no doubt that which is best adapted to enable it to perform its various functions. From these observations it must appear, that although this arrangement must be mentioned as a modification of the lever, it cannot, in strictness, be called a mechanical power; since its resisting arm is in all cases, except one, longer than the acting arm, and in that one case is equal to it, on which account it never can gain power, but in most instances must lose it.

The Wheel and Axle is the next mechanical power to be considered; it must be well known to every reader who has seen a village well; for it is by this power that the bucket is drawn up, although in such cases, instead of a wheel attached to the axle, there is generally only a crooked handle, which answers the purpose of winding the rope round the axle, and thus raising the bucket, as may be seen in the engraving at the head of our third Chapter. It is evident, however, that this crooked handle is equivalent to a wheel; for the handle describes a circle as it revolves, while the straight piece which is united to the axle corresponds with the spoke of a wheel. This power may be resolved into a lever; in fact, what is it but a lever moving round an axle? and always retaining the effect gained during every part of the motion, by means of a rope wound round the butt end of the axle; the spoke of the wheel being the long arm of the lever, and the half diameter of the axle its short arm. The axle is not in itself a mechanical power, for it is as impotent as a lever, whose fulcrum is in the centre; but add to it the wheel, and we have a power which will increase in proportion as the circumference of the wheel exceeds that of the axle. This arises from the velocity of the circumference being so much greater than that of the axle, as it is further from the centre of motion; for the wheel describes a great circle in the same space of time that the axle describes a small one; therefore the power is increased in the same proportion as the circumference of the wheel is greater than that of the axle. Those who have ever drawn a bucket from a well by this machine, must have observed, that as the bucket ascended nearer the top the difficulty increased; such an effect must necessarily follow from the views we have just offered; for whenever the rope coils more than once the length of the axle, the difference between its circumference and that of the wheel is necessarily diminished. To the principle of the wheel and axle may be referred the capstan, windlass, and all those numerous kinds of cranes which are to be seen at the different wharfs on the banks of the river Thames. It is scarcely necessary to add, that the force of the wind-mill depends upon a similar power. The *tread-mill* furnishes another striking example. The wheel and axle is sometimes used to multiply motion, instead of to gain power, as in the multiplying wheel of the common jack, to which it is applied when the weight cannot conveniently have a long line of descent; a heavy weight is in this case made to act upon the axle, while the wheel, by its greatest circumference, winds up a much longer quantity of line than the simple descent of the weight could require, and thus the machine is made to go much longer without winding than it otherwise would do.

The Pulley is a power of very extensive application. Every one must have seen a pulley; it is a circular and flat piece of wood or metal, with a string which runs in a groove round it. Where, however, this is fixed, it cannot afford any power to raise a weight; for it is evident, that, in order to raise it, the power must be greater than the weight, and that if the rope be pulled down one inch, the weight will only ascend the same space; consequently, there cannot be any mechanical advantage from the arrangement. This, however, is not the case, where the pulley is not fixed. Suppose one end of the rope be fastened to a hook in the ceiling, and that to the moveable pulley on the rope a cask be attached, is it not evident that the hand applied to the other extremity of the rope will sustain it more easily than if it held the cask suspended to a cord without a pulley? Experience shows that this is the fact, and theory explains it by suggesting that the fixed hook sustains half the weight, and that the hand, therefore, has only the other half to sustain. The hook will also afford the same assistance in raising the weight as in sustaining it; if the hand has but one half the weight to sustain, it will also have only one half the weight to raise; but observe, says Mrs. Marcet, that in raising the weight, the velocity of the hand must be double that of the cask; for in order to raise the weight one inch the hand must draw each of the strings one inch; the whole string is therefore shortened two inches, while the weight is raised only one. Pulleys then act on the same principle as the lever, the deficiency of strength of the power being compensated by its superior velocity. It will follow, from these premises, that the greater the number of pulleys connected by a string, the more easily the weight is raised, as the difficulty is divided amongst the number of strings, or rather of parts into which the string is divided by the pulleys. Several pulleys, thus connected, form what is called a system, or tackle of pulleys. They may have been seen suspended from cranes, to raise goods into warehouses, and in ships to draw up the sails.

The Inclined Plane is a mechanic power which is seldom used in the construction of machinery, but applies more particularly to the moving or raising of loads upon slopes or hills, as in rolling a cask up or down a sloping plank into or out of a cart or cellar, or drawing a carriage up a sloping road or hill, all which operations are performed with less exertion than would be required if the same load were lifted perpendicularly. It is a power which cannot be resolved into that of the lever; it is a distinct principle, and those writers who have attempted to simplify the mechanical powers, have been obliged to acknowledge the inclined plane as elementary. The method of estimating the advantage gained by this mechanical power is very easy; for just as much as the length of the plane exceeds its perpendicular height, so much is the advantage gained; if, for instance, its length be three times greater than its height, a weight could be drawn to its summit with a third part of the strength required for lifting it up at the end; but, in accordance with the principle so frequently alluded to, such a power will be at the expense of time, for there will be three times more space to pass over. The reason why horses are eased by taking a zigzag direction, in ascending or descending a steep hill, will appear from the preceding account of the action of the inclined plane, because in this way the effective length of the inclining surface is increased while its height remains the same.

The Wedge is rather a compound, than a distinct mechanical power; since it is composed of two inclined planes, and in action frequently performs the functions of a lever. It is sometimes employed in raising bodies, thus the largest ship may be raised to a small height by driving a wedge below it; but its more common application is that of dividing and cleaving bodies. As an elevator, it resembles exactly the inclined plane; for the action is obviously the very same, whether the wedge be pushed under the load, or the load be drawn over the wedge. But when the wedge is drawn forward, the percussive tremor excited destroys, for an instant, the adhesion or friction at its sides, and augments prodigiously the effect. From this principle chiefly is derived the power of the wedge in rending wood and other substances. It then acts besides as a lever, insinuating itself into the cleft as fast as the parts are opened by the vibrating concussion. To bring the action of the wedge, therefore, under a strict calculation, would be extremely difficult, if not impossible. Its effects are chiefly discovered by experience. All the various kinds of cutting tools, such as axes, knives, chisels, saws, planes, and files, are only different modifications of the wedge.

The Screw is a most efficient mechanic power, and is of great force and general application. It is in reality nothing more than an inclined plane formed round a cylinder, instead of being a continued straight line. Its power is, therefore, estimated by taking its circumference, and dividing this by the distance between any two of its threads; for what is taking the circumference of a screw, but another mode of measuring the length of the inclined plane which wraps round it? and taking the distance between one thread and the next to it, is but measuring the rise of that inclined plane in such length; and from the properties of the inclined plane, it follows, that the closer the threads of a screw are together, in proportion to its diameter, the greater will be the power gained by it.

Note 6. p. 162.

If some extraneous force were were not applied, in a clock or watch, to maintain or perpetuate the natural vibrations of a pendulum, or oscillations of a balance, they would soon come to rest, by reason of friction in the mechanism, and the resistance opposed by the air to the parts in motion. This force, in the larger clocks, is usually a suspended weight; but, in the portable clock and watches, it is a spring coiled in a metallic box, that actuates the wheel-work by gradually unbending itself.

In the former of these cases, the weight is suspended by a cord or chain that is coiled round a cylinder when wound up, which cylinder being of uniform diameter throughout its length, is acted on by the cord, when fast at the interior end, by a similar force in every situation; and, therefore, imparts through the train, connected with its great wheel, invariable impulses to the escapement-wheel, at every vibration of the pendulum; which pendulum receives therefrom such a slight push, as is just sufficient to restore the momentum which it loses from friction and the air's resistance, and thus the uniform motion of the pendulum is perpetuated. But when a spring is substituted for a weight, it is clear that its agency cannot be uniform, since, as the reader will learn by turning to page 171., it is a general law, that elastic bodies, in the recovery of their form, after the removal of the compressing force, exert a greater power at first than at last, so that the whole progress of restoration is a *retarded* motion. It, therefore, became necessary to introduce some mechanical contrivance which might equalize such motion. This correction is effected by an apparatus termed a FUSEE, and is nothing more than the application of the wheel and axle; it is that conical barrel seen in most watches round which the chain coils in the act of winding up. When the fusee is full of chain, or the watch is wound up, the spring, through the medium of the chain, will act upon its upper part, which being very near the centre will give the spring but little power; but, as the spring uncoils and diminishes in strength, it will act upon a larger part of the fusee, until at last it gets to the bottom of it, and consequently, if the several increasing grooves upon it are made to increase in the same proportion as the power of the spring decreases, an equable force must be obtained.

NOTE 7. p. 162.

The elastic property of iron springs has been lately exemplified in a very striking manner, by the invention of Pratt's elastic chairs and beds; which, instead of the usual stuffing of feathers, are filled with iron wire!!! which is twisted into spiral form. Down itself cannot be more gentle nor springy; it yields to pressure, and yet never becomes lumpy: beds thus constructed have the advantage of not heating the body; and, above all, they never require to be shaken or "made." Had Vulcan fortunately made such a discovery before his ejectment from Olympus, his wife, Venus, would surely never have treated him with that contempt which mythologists have recorded of her; while her priestesses, the house-maids, must, in gratitude, have been bound to extend their protection to a benefactor, who could save them so much daily labour. For particulars of this curious invention, the reader may consult the *Literary Gazette* for March 17. 1827.

NOTE 8. p. 164.

The phenomenon has been explained as depending upon the inertia of the parts of matter, which renders a certain time necessary in order to communicate to any body a sensible motion; so that when a body, moving with considerable velocity, meets with another of much greater size, it experiences almost as much resistance as if the latter were fixed. Nothing is easier to be divided than water; yet, if the palm of the hand be struck with some velocity against its surface, a considerable degree of resistance, and even of pain, is experienced from it, as if a solid body had been struck; nay, a musket-ball, when fired against water, is repelled and even flattened by it. In like manner, if we load a musket with powder, and instead of a ball, introduce a candle, and fire it against a board, the latter will be pierced by the candle end, as if by a ball. The cause of this phenomenon, no doubt, is that the rapid motion with which the candle end is impelled, does not allow it time to be flattened, and therefore it acts as a hard body.

NOTE 9. p. 165.

Impatiens, or *Touch me not*, affords a good example. The seed-vessel consists of one cell with five divisions; each of these, when the seed is ripe, on being touched, suddenly folds itself into a spiral form, leaps from the stalk, and disperses the seeds to a great distance by its elasticity. The capsule of the geranium and the beard of wild oats are twisted for a similar purpose. (DARWIN'*s* *Botanic Garden.*) The seed-vessel of euphorbia is extremely elastic, projecting the seeds with great force. An elastic pouch also serves to scatter the seeds of the oxalis.

NOTE 10. p. 173.

"When a native of Macoushi goes in quest of feathered game, or other birds, he seldom carries his bow and arrows. It is the *blow-pipe* he then uses. This extraordinary tube of death is, perhaps, one of the greatest natural curiosities in Guiana. It is not found in the country of Macoushi. Those Indians tell you that it grows to the south-west of them, in the wilds which extend betwixt them and the Rio Negro. The reed must grow to an amazing length, as the part the Indians use is from ten to eleven feet long, and no tapering can be perceived in it, one end being as thick as the other. It is of a bright yellow colour, perfectly smooth both inside and out. It grows hollow; nor is there the least appearance of a knot or joint throughout the whole extent. The natives call it *ourah*. This, of itself, is too slender to answer the end of a blow-pipe; but there is a species of palma, larger and stronger, and common in Guiana, and this the Indians make use of as a case, in which they put the *ourah*. It is brown, susceptible of a fine polish, and appears as if it had joints five or six inches from each other. It is called *samourah*, and the pulp inside is easily extracted, by steeping it for a few days in water. Thus the ourah and samourah, one within the other, form the blow-pipe of Guiana. The end which is applied to the mouth is tied round with a small silk-grass cord, to prevent its splitting; and the other end, which is apt to strike against the ground, is secured by the seed of the acuero fruit, cut horizontally through the middle, with a hole made in the end, through which is put the extremity of the blow-pipe. It is fastened on with string on the outside, and the inside is filled up with wild bees-wax. The arrow is from nine to ten inches long. It is made out of the leaf of a species of palm-tree, called *coucourite*, hard and brittle, and pointed as sharp as a needle. About an inch of the pointed end is poisoned with the *wourali*. The other end is burnt, to make it still harder, and wild cotton is put round it for about an inch and a half. It requires considerable practice to put on this cotton well. It must just be large enough to fit the hollow of the tube, and taper off to nothing downwards. They tie it on with a thread of the silk grass, to prevent its slipping off the arrow.

" The Indians have shown ingenuity in making a quiver to hold the arrows. It will contain from five to six hundred. * * * * *

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With a quiver of poisoned arrows slung over his shoulder, and with his blow-pipe in his hand, in the same position as a soldier carries his musket, see the Macoushi Indian advancing towards the forest in quest of powises, maroudis, waracabas, and other feathered game.

" These generally sit high up in the tall and tufted trees, but still are not out of the Indian's reach; for his blow-pipe, at its greatest elevation, will send an arrow 300 feet. Silent as midnight he steals under them, and so cautiously does he tread the ground, that the fallen leaves rustle not beneath his feet. His ears are open to the least sound, while his eye, keen as that of the lynx, is employed in finding out the game in the thickest shade. Often he imitates their cry, and decoys them from tree to tree, till they are within range of his tube. Then taking a poisoned arrow from his quiver, he puts it in the blow-pipe, and collects his breath for the fatal puff. About two feet from the end through which he blows, there are fastened two teeth of the acouri, and these serve him for a sight.

Silent and swift the arrow flies, and seldom fails to pierce the object at which it is sent. Sometimes the wounded bird remains in the same tree where it was shot, and in three minutes falls down at the Indian's feet. Should he take wing, his flight is of short duration, and the Indian, following the direction he has gone, is sure to find him dead. It is natural to imagine that, when a slight wound only is inflicted, the game will make its escape. Far otherwise; the woorali poison almost instantaneously mixes with blood or water, so that if you wet your finger, and dash it along the poisoned arrow in the quickest manner possible, you are sure to carry off some of the poison. Though three minutes generally elapse before the convulsions come on in the wounded bird, still a stupor evidently takes place sooner, and this stupor manifests itself by an apparent unwillingness in the bird to move.

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"The Indian, on his return home, carefully suspends his blow-pipe from the top of his spiral roof; seldom placing it in an oblique position, lest it should receive a cast." — WATERTON's *Wanderings in South America*, p. 58.

NOTE 10. p. 212.

If a cone, or sugar-loaf, be cut through in certain directions, we shall obtain certain figures which are termed *conic sections;* thus, if we cut through the sugar-loaf in a direction parallel to its base, or bottom, the outline or edge of the loaf where it is cut will be a *circle.* If the cut is made so as to slant, and not be parallel to the base of the loaf, the outline is an *ellipse,* provided the cut goes quite through the sides of the loaf all round; but if it goes slanting, and parallel to the line of the loaf's side, the outline is a *parabola*, a conic section, or curve, to which this note more immediately relates. This curve is distinguished by characteristic properties, every point of it bearing a certain fixed relation to a certain point within it, as the circle does to its centre.

NOTE 11. p. 219.

During the dreadful earthquake of Lisbon, bands of wretches took advantage of the general consternation to commit the most atrocious acts of robbery and murder. In fact a considerable part of the city was destroyed by incendiaries, who, during the disaster, set fire to the houses, that they might pillage them with greater impunity.

NOTE 12. p. 220.

Soils consist of a mixture of different finely divided earthy matter, with animal or vegetable substances in a state of decomposition. In order, therefore, to form a just idea of their nature, it is necessary to conceive different rocks decomposed, or ground into parts and powder of different degrees of fineness; some of their soluble parts dissolved by water, and that water adhering to the mass, and the whole mixed with larger or smaller quantities of the remains of vegetables and animals, in different stages of decay. Hence it will follow, that certain rocks will give origin to particular soils; thus poor and hungry soils, such as are produced from the decomposition of granite and sandstone, remain very often for ages with only a thin covering of vegetation; while soils from the decomposition of limestone, chalk, and basalt, are often clothed by nature with the perennial grasses; and afford, when ploughed up, a rich bed of vegetation for every species of cultivated plant. In adverting to this subject, Dr. Buckland, in his inaugural lecture, very justly observes, that it furnishes an instance of relation between the vegetable and mineral kingdoms, and of the adaptation of one to the other, which always implies design in the surest manner; for had not the surface of the earth been thus prepared for their reception, where would have been the use of all that admirable system of organization bestowed upon vegetables? And it is no small proof of design in the arrangement of the materials that compose the surface of our earth, that whereas the primitive and granitic rocks are least calculated to afford a fertile soil, they are for the most part made to constitute the mountain districts of the world, which, from their elevation and irregularities, would otherwise be but ill adapted for human habitation; whilst the lower and more temperate regions are usually composed of derivative or secondary strata, in which the compound nature of their ingredients qualifies them to be of the greatest utility to mankind by their subserviency to the purposes of luxuriant vegetation.

No doubt, then, can exist as to the important connection between the geological structure of a country, and its degree of fertility; but the subject has not received the attention which it merits. Geological memoirs abound with hints and scattered notices, but we believe that, with the exception we are about to notice, there does not exist any memoir which professes to describe the different rocks in a neighbourhood, with a view to trace the variations in its soils according to the change of the substrata. The essay to which we allude, is a paper published in the first volume of the Transactions of the Royal Geological Society, entitled, "*Observations on the Geological Structure of Cornwall, with a view to trace its connection with, and influence upon its agricultural economy, and to establish a rational system of improvement by the scientific application of mineral manure.*" We shall extract some passages from this paper, in order to confirm the assertion made in the text. "There is certainly no district in the British empire where the natural relations between the varieties of soil and the subjacent rocks can be more easily discovered and traced, or more effectually investigated, than in the county of Cornwall; and no where can the information, which such an enquiry is calculated to afford, be more immediately and successfully applied for the improvement of waste lands, and the general advancement of agricultural science.

"As we advance from a primitive to an alluvial district, the relations to which I have alluded become gradually less distinct and apparent, and are ultimately lost in the confused complication of the soil itself, and in that general obscurity which necessarily envelopes every object in a state of decomposition: we can, therefore, only hope to succeed in such an investigation by a patient and laborious examination of a primitive country, after which we may be enabled to extend our enquiries with advantage through those districts which are more completely covered with soil, and obscured by luxuriant vegetation; as the eye gazing upon a beautiful statue, traces the outline of the limbs, and the swelling contour of its form, through the flowing draperies which invest it. The county of Cornwall may be said to consist of four primary rocks, each of which, by decomposition, gives origin to a peculiar soil, distinct in its nature and characters, and requiring an appropriate system of cultivation and improvement. They all, however, agree in one essential particular, their earthy combinations are few and simple; the great object of art, therefore, is to extend and multiply them, and thereby to increase and diversify their chemical and mechanical agencies. In alluvial districts the very contrary obtains, for nature has already mixed and compounded the different particles of rocks in every proportion, and in every manner, and has therefore left but little to be effected by the suggestions of science, or the resources of art. The principal rocks of which Cornwall consists are granite, slate, hornblende rocks, and serpentine. Beds of limestones, dykes of porphyry, veins of quartz, and those of other minerals, will also claim a portion of our attention, inasmuch as they produce an influence upon the soils beneath which they occur.

"Granite forms the skeleton of the county, upon which all the other formations repose; the soil to which its disintegration gives origin, is provincially termed a *growan soil;* it occupies a very considerable area of the peninsula of Cornwall, constituting not less than 300,000 acres, one half of which is uninclosed waste land, affording a scanty pasturage for a miserable breed of sheep and goats; but which, by drainage and judicious cultivation, might, without doubt, be much improved. The other portion of *growan* land is endowed with various degrees of fertility and capability of improvement, in different districts, or even in different spots in the same district; a fact which seems to have an immediate connection with the nature of the granitic substratum, and consequently to admit of elucidation from the enquiries of the geologist. That the texture of granite, and the proportion of its component parts, have a considerable influence upon the fertility of the superincumbent soil, will become evident on a bare inspection of specimens brought from fertile and barren districts. Mr. Tyacke, of Godolphin, has furnished the society with some striking specimens in confirmation of this fact, and others equally satisfactory and conclusive have been added by Mr. Giddy, the active curator of the museum. It is hardly necessary to remark, that granite consists of three substances in the state of mechanical admixture, viz. *felspar*, *mica*, and *quartz*, the first and last of which being essentially different in chemical composition, are necessarily so in their agricultural influence. Felspar is capable of being, in part, resolved into aluminous earth, and includes, moreover, several elements which have been discovered by experience to be highly congenial to the process of vegetation; quartz, on the contrary, has a powerful tendency to resist disintegration, and, even when it is decomposed, is reduced only into siliceous particles. The nature of felspar varies also very considerably in different kinds of granite; it occurs sometimes in an earthy form, is easily pulverized, and emits, when breathed upon, a strong smell of aluminous earth; at other times, it is met with in a hard, compact, and less earthy state, not easily yielding to the action of air and moisture. In some felspar the proportion of its siliceous greatly exceeds that of its aluminous elements, and in others, again, magnesia forms a constituent part. The relative proportion of mica appears also to have some influence, and where this ingredient occurs in considerable quantities, it is generally indicative of a poor and light soil. There are, besides, incidental ingredients in granite which must be taken into account, such, for instance, as iron, whose presence not only disposes the rock to a more rapid decomposition, but frequently becomes a useful element in the resulting soil. It would appear, then, from these views, that the value of a *growan* soil will bear a relation to the proportion of felspar in the subjacent granite; it is, therefore, a circumstance which should always be examined by the scientific agriculturist, who wishes to form a correct estimate of the capabilities of any granite district. Upon an examination of many of the more fertile parts of Cornwall, this fact is very strikingly exemplified; it will be found, that in such districts the quantity of felspar in the granite varies from 70 to 90 per cent.; and that it possesses also the earthy texture which so greatly accelerates its decomposition; this is one of the mineralogical circumstances which will explain the unusual fertility of Saint Burian, Sennan, and Saint Levan, near the Land's End; the lands of which are let, upon an average, at the rent of four pounds per acre. On the other hand, let the geologist, on passing over the dreary and barren moors which occupy the middle of the county, collect specimens of its granite, and they will be found to offer a striking contrast to those of more fruitful districts; many other instances might be mentioned, but the geologist will have no difficulty in multiplying them. As a general rule it may be stated, that in order to obtain the greatest fertility, the proportion of siliceous matter in a soil ought to be increased according to the quantity of rain that falls, or rather, perhaps, to the frequency of its recurrence; for it is evident, that one of the principal effects of this element, is to diminish in the soil its capacity for moisture; we accordingly find, that in the rainy climate of Turin, the most prolific soil has from 77 to 80 per cent. of siliceous, and from 9 to 14 of calcareous earth; whereas in the neighbourhood of Paris, where there is much less rain, the silex bears only the proportion of from 26 to 50 *per* cent. in the most fertile districts.

“Let the agriculturist of Cornwall, then, if there be any who repine at the moisture of their climate, hail with gladness those golden showers that fill their granaries with corn, and clothe their pastures with perpetual verdure.

“We cannot contemplate this circumstance, without discovering the agency of that intelligence which Nature so constantly displays in connecting the wants and necessities of the different parts of creation with the power and means of supplying them; thus, in primitive countries, like Cornwall, the soil necessarily requires moisture, and we perceive that the cause which occasions, at the same time supplies, this want; for the rocks elevated above the surface solicit a tribute from every passing cloud, whilst in alluvial and flat districts, where the soil is rich, deep, and retentive of moisture, the clouds float undisturbed over the plains, and the country frequently enjoys that long and uninterrupted series of dry weather which is so congenial and necessary to its fertility. Linnæus observes, that the plants which chiefly grow upon the summits of mountains are rarely found in any other situation, except in marshes; because the clouds, arrested in their progress by such elevations, keep the air in a state of perpetual moisture, somewhat resembling that of the fogs in meadows and marshes; in exemplification of this fact, the locality of *parnassia palustris* immediately suggests itself to our notice.

"The essential character of a *growan*, or granitic soil, may be stated to be a peculiar unsusceptibility to all external agents, and an inaptitude in its internal composition, to those chemical changes with which fertility seems connected. There is rarely much soluble matter in such soils. These observations, however, apply with different degrees of force to different districts, according to the value of the soil, and to the extent of judicious improvement which it may have undergone. As a rule for the amelioration of a *growan* soil it may be recommended, as a general principle, to increase the number of its elements, and, consequently, to extend their affinities. The Cornish code of agricultural improvement, and which, indeed, may be applied to most primitive districts, is to be very shortly expressed—MIX, COMBINE, AND MULTIPLY MANURES.—In the treatment of a siliceous soil, in particular, the manures cannot be too complicated; and those of an animal and vegetable nature should be always previously mixed with clay, decomposing slate, or other illaceous matter, with which they may contract an intimate union, and by such means be more securely preserved in the land to which they are applied. Mr. Scobell, of Nancealverne, near the Land's End, communicated to the author a singular practice which the farmers in his neighbourhood pursued with evident advantage, that of actually dressing their sterile lands with the comminuted fragments of decomposing granite. Strange and problematical as such a practice may appear to the agriculturalist, who has not studied the subject of mineral manures, to the chemist it is a fact of easy and satisfactory explanation; the decomposing granite contains, as before stated, large quantities of felspar, and therefore of alumina, with, perhaps, small quantities of alkali. Upon the same principle the application of decomposing *clay-slate* proves a valuable manure for siliceous lands, since it contains alumina in great quantities, and is therefore capable of imparting to them that tenacity of which such soils are destitute.

"The intermixture of soils, or of decomposing rocks capable of producing them, where one kind of earth is either redundant or deficient, has been most successfully practised in other counties. Mr. Bakewell, in his Introduction to Geology, observes, that part of Lancashire is situated on the *red sand rock*, which being principally composed of siliceous earth and the oxide of iron, forms of itself very unproductive land; but that, fortunately, in many situations, it contains detached beds of calcareous marle, by the application of which it is converted into a most fertile soil. Mr. Brende has also remarked, that experience and science have greatly improved the advantages to be derived from the proximity of different soils to each other, and that there can be no better illustration of the utility of an intimate acquaintance with the relation of the different strata, than the amelioration of the Suffolk sands, which, by the proper application of a substratum of a shelly marle, provincially termed *crag*, have been changed from a parched and useless heath to arable and productive land.

"A most interesting illustration of the above views seems to be presented in an extraordinary fact lately discovered in the county of Cornwall, respecting the increased fertility which characterises soils that are superincumbent upon the junctions of rocks. The most superficial observer may easily satisfy himself of the truth of this fact: indeed the line of junction between the granite and slate formations may, in many parts, be traced by the eye alone through tracts of cultivation, from the remarkable fertility which attends it. It may be defined a *zone of fertility*, since both the growan and slaty soils become mutually enriched as they approach each other; numerous are the examples which might be adduced in confirmation of this fact; the following, as being accessible to investigation, are here particularised. The most valuable part of the estate of Trangwainton, the seat of Sir Rose Price, Bart., lies upon a junction of slate and granite; this line may be traced to Madron church, and from thence round the Mount's Bay, in the direction of which we shall invariably find the superincumbent soil distinguished for its superior fruitfulness. It is, perhaps, worth notice, that all the villas around this beautiful bay are placed upon the junction of rocks. Where the *hornblende formation* intrudes itself, the fertility of the land is still further increased, as may be seen on the valuable estates of Castle Horneck and Trereiffe. The zone of fertility may be also seen well characterised on the line of junction between granite and slate at Penrhyn, and on that extending from Chyoon on the acclivity of Paul Hill, to Mousehole, in the Mount's

Bay; this latter instance attracted the attention of Mr. Worgan, who, in his general view of the agriculture of Cornwall, notices this district as one highly fertile, and as being famous for producing two crops of potatoes in one year. On Saint Michael's Mount, that "precious stone, set in the silver sea," the geologist will also discover a good example of the fertilizing influence which the junction of slate and granite exerts upon the superincumbent soil; the beautiful carpet of herbage covering the south-eastern base of this singular spot is a feature which instantly strikes the attention of the stranger."

Note 13. p. 220.

The geological researches of Doctor Buckland, have been long directed by a desire to accumulate facts, to prove that there must have been an universal inundation of the earth; and, in his inaugural lecture, he has presented us with a summary of such facts which, to use his own expression, whether considered collectively or separately, present such a conformity of proofs, tending to establish the universality of a recent inundation of the earth, as no difficulties or objections that have hitherto arisen, are in any way sufficient to overrule. The facts are as follow.

"I. The general shape and position of hills and valleys; the former having their sides and surfaces universally modified by the action of violent waters, and presenting often the same alternation of salient and retiring angles, that mark the course of a common river; and the latter, in those cases which are called valleys of denudation, being attended with such phenomena, as shew them to owe their existence entirely to excavation, under the action of a flood of waters.

II. The almost universal confluence and successive inosculations of minor valleys with each other, and final termination of them all in some main trunk, which conducts their waters to the sea; and the rare interruption of their courses by transverse barriers producing lakes.

III. The occurrence of detached insulated masses of horizontal strata called *outliers*, at considerable distances from the beds of which they once evidently formed a continuous part, and from which they have been separated at a recent period, by deep and precipitous valleys of denudation.

IV. The immense deposits of gravel that occur occasionally on the summit and slopes of hills, and almost universally in valleys over the whole world; in situations to which no torrents or rivers that are now in action could ever have drifted them.

V. The nature of this gravel, being in part composed of the wreck of the neighbouring hills, and partly of fragments and blocks that have been transported from very distant regions.

VI. The nature and condition of the organic remains peculiar to this gravel; many of them being identical with, and others not distinguishable from, species that now exist, and very few having undergone the smallest process of mineralization. Their condition resembles that of common grave bones, being in so recent a state, and having undergone so little decay, that if the records of history, and the circumstances that attend them, did not absolutely forbid such a supposition, we should be inclined to attribute them even to a much later period than the deluge; and certainly there is not a single fact connected with them, that should lead us to date their origin from any more ancient era.

VII. The total impossibility of referring any one of these appearances to the effect of ancient or modern rivers, or any other causes, that are now, or appear ever to have been, in action, since the retreat of the diluvian waters.

VIII. The analogous occurrence of similar phænomena in almost all the regions of the world that have hitherto been scientifically investigated, presenting a series of facts that are uniformly consistent with the hypothesis of a contemporaneous and diluvial origin.

IX. The perfect harmony and consistency in the circumstances of those few changes that now go on (*e. g.* the formation of ravines and gravel by mountain torrents; the limited depth and continual growth of peat bogs, the formation of tufa, sand-banks, deltas, coral reefs, and streams of lava; and the filling up of lakes, estuaries, and marshes,) with the hypothesis which dates the commencement of all such operations, at a period not more ancient than that which our received chronologies assign to the deluge."

In the collection and arrangement of the foregoing facts, we discern the operations of a mind laborious in research; and so logically constituted as to be enabled to separate the strong proofs from the weaker and lesser important matter with which they are mixed up; but we have now to view the labours of Dr. Buckland in a very different light; we have to regard him no longer as the able reasoner upon known phænomena, but as the original discoverer of new facts, highly important in their inferences, and calculated to furnish additional support to the theory, of which he is so powerful an advocate.

In the year 1822, Dr. Buckland read a memoir before the Royal Society, announcing the discovery of a singular cave at Kirkdale in Yorkshire, containing an assemblage of fossil teeth and bones of the elephant, rhinoceros, hippopotamus, bear, tiger, and hyæna, and sixteen other animals; with a comparative view of five similar caverns in various parts of England, and others on the continent. For this important paper the society awarded to its author their Copley medal; and it constitutes the basis of a later and much more extended work, entitled "RELIQUIÆ DILUVIANÆ; or Observations on the Organic Remains contained in Caves, Fissures, and Diluvial Gravel; and on other Geological Phenomena, attesting the Action of an Universal Deluge. By the Rev. W. BUCKLAND, B. D. F. R. S. &c."

Kirkdale is situated about 25 miles N. N. E. of the city of York, between Helmsley and Kirby Moorside, near the point at which the east base of the Hambleton hills, looking towards Scarborough, subsides into the vale of Pickering, and on the south extremity of the mountainous district known by the name of the Eastern and Cleveland moorlands.

The substratum of this valley is a mass of stratified clay, identical with that which at Oxford and Weymouth reposes on a similar limestone to that of Kirkdale, and containing, subordinately, beds of inflammable bituminous shale, like that of Kimeridge in Dorsetshire. Its south boundary is formed by the Howardean hills, and by the elevated escarpement of the chalk, that terminates the Wolds towards Scarborough. Its north frontier is composed of a belt of limestone, extending eastward 30 miles from the Hambleton hills, near Helmsley, to the sea at Scarborough, and varying in breadth from four to seven miles; this limestone is intersected by a succession of deep and parallel valleys (called *dales*,) through which the following rivers from the moorlands pass down southwards the vale of Pickering, viz. the Rye, the Rical, the Hodge Beck, the Dove, the Seven Beck, and the Costa; their united streams fall into the Derwent above New Malton, and their only outlet is by a deep gorge, extending from near this town down to Kirkham, the stoppage of which would at once convert the whole vale of Pickering into an immense inland lake; and before the excavation of which, it is probable that such a lake existed, having its north border nearly along the edge of the belt of limestone just described, and at no great distance from the mouth of the cave at Kirkdale.

The position of the cave is at the south and lower extremity of one of these dales (that of the Hodge Beck), at the point where it falls into the vale of Pickering. It occurs in that species of limestone rock which is usually perforated by irregular holes and caverns intersecting them in all directions. The abundance of such cavities in the limestone of the vicinity of Kirkdale is evident from the fact of the engulfment of several of the rivers above enumerated, in the course of their passage across it; and it is important to observe, that the elevation of the Kirkdale cave above the bed of the Hodge Beck, being nearly 80 feet, excludes the possibility of our attributing the muddy sediment we shall find it to contain to any land flood, or extraordinary rise of the waters of this, or of any other river in the neighbourhood.

But let us explore the interior of this cavern. It was not till the summer of 1821, that the existence of any animal remains, or of the cavern containing them, was suspected. At this time, in continuing the operations of a large quarry, the workmen accidentally intersected the mouth of a long hole, closed externally with rubbish, and overgrown with grass and bushes. As this rubbish was removed before any competent person had examined it, it is not certain whether it was composed of diluvial gravel and rolled pebbles, or was simply the debris that had fallen from the softer portions of the strata that lay above it; the workman, however, who removed it, and some gentlemen who saw it, assured Dr. Buckland that it was composed of gravel and sand. In the interior of the cavern, our indefatigable geologist could not find a single rolled pebble, nor has he ever seen one bone, or fragment of bone, that bore the slightest mark of having been rolled by the action of water.

The original entrance is said to have been very small, and having been filled up as above described, there could not have been any admission of external air through it to the interior of the cavern. Nearly 30 feet of its outer extremity have now been removed, and the present entrance is a hole in the perpendicular face of the quarry, about three feet high and five feet broad, which it is only possible for a man to enter on his hands and knees, and which expands and contracts itself irregularly from two to seven feet in breadth, and two to fourteen feet in height. It is unnecessary to enter into farther details; the reader, if he wishes more minute information, may consult Dr. Buckland's work.

On entering the cave, the first thing observed was a sediment of soft mud or loam, covering entirely its whole bottom to the average depth of about a foot, and concealing the subjacent rock, or actual floor of the cavern. Not a particle of mud was found attached either to the sides or roof; nor was there a trace of it adhering to the sides or upper portions of the transverse fissures, or anything to suggest the idea that it had entered through them. The mud was covered by a *stalagmytic* crust, which had been formed by the dripping of water impregnated with calcareous matter, as is common in all the cavities of limestone; but it is important to remark, that there was not any alternation of mud with any repeated beds of *stalagmyte*, but simply a partial deposit of the latter on the floor beneath; so that the mud was encased, like meat in a pie, with an upper and under crust. It was chiefly in the lower part of the earthy sediment, and in the calcareous matter beneath it, that the animal remains were found.

In the whole extent of the cave, only a very few large bones have been discovered that are tolerably perfect; most of them are broken into small angular fragments and chips, the greater part of which lay separately in the mud, whilst others were wholly or partially invested with stalagmite; and others again mixed with masses of still smaller fragments. In some few places, where the mud was shallow, and the heaps of teeth and bones considerable, parts of the latter were elevated some inches above the surface of the mud and its calcareous crust; and the upper ends of the bones thus projecting, like the legs of pigeons through a pie crust, into the void space above, have become thinly covered with calcareous drippings, whilst their lower extremities have no such incrustation, and have simply adhering to them the mud in which they have been imbedded.

The effect of the loam and stalagmite in preserving the bones from decomposition, by protecting them from all access of atmospheric air, has been very remarkable.

The workmen, in first discovering the bones at Kirkdale, supposed them to have belonged to cattle that died by a murrain in this district a few years ago, and they were for some time neglected, and thrown on the roads with the common limestone; they were, at length, noticed by Mr. Harrison, a medical gentleman in the neighbourhood, and have since been collected and deposited in various private and public museums. The teeth and bones which have been discovered in this cave appear to have belonged to the *hyæna*, *tiger*, *bear*, *wolf*, *fox*, *weasel*, *elephant*, *rhinoceros*, *hippopotamus*, *horse*, *ox*, *deer*, *hare*, *rabbit*, *water-rat*, *mouse*, *raven*, *pigeon*, *lark*, *snipe*, and a small species of *duck*.

The bottom of the cave on first removing the mud, was found to be strewed all over like a dog-kennel, from one end to the other, with hundreds of teeth and bones, or rather broken and splintered fragments of bones, of all the animals above enumerated; scarcely a single bone has escaped fracture, with the exception of some of the more solid and hard bones of the foot; on some of these bones, marks may be traced, which, on applying one to the other, appear exactly to fit the form of the canine teeth of the hyæna that occur in the cave. The hyæna's bones have been broken, and apparently gnawed equally with those of the other animals. Heaps of small splinters, and highly comminuted, yet angular fragments of bone, mixed with teeth of all the varieties of animals above enumerated, lay in the bottom of the den, occasionally adhering together by calcareous cement. Not one skull is to be found entire; and it is so rare to find a large bone of any kind that has not been more or less broken, that there is no hope of obtaining materials for the construction of a single limb, and still less of an entire skeleton. The jaw-bones, also, even of the hyænas, are broken to pieces like the rest.

It must already appear probable, from the facts above described, particularly from the comminuted and gnawed condition of the bones, that the cave at Kirkdale was, during a long succession of years, inhabited as a den by hyænas, and that they dragged into its recesses the other animals, whose remains are found indiscriminately mixed with their own; an hypothesis which is certainly strengthened by Dr. Buckland having found the excrement of the animal in the same cave. Should it be asked why we do not find, at least, the entire skeleton of the one or more hyænas that died last and left no survivors to devour them; we find a sufficient reply to this question, in the circumstance of the probable destruction of the last individuals by the waters of the deluge. On the rise of these, had there been any hyænas in the den, they would have rushed out, and fled for safety to the hills; and if absent, they could not by any possibility have returned to it from the higher levels; that they were extirpated by the catastrophe is obvious, from the discovery of their bones in the diluvial gravel both of England and Germany.

The accumulation of these bones, then, appears to have been a process of years, whilst all the animals in question were natives of this country. The general dispersion of bones of the same animals through the diluvian gravel of high latitudes, over a great part of the northern hemisphere, shows that the period in which they inhabited these regions was that immediately preceding the formation of this gravel, and that they perished by the same waters which produced it. M. Cuvier has, moreover, ascertained that the fossil elephant, rhinoceros, hippopotamus, and hyæna, belong to species now unknown; and as there is no evidence that they have at any time, subsequent to the formation of the diluvium, existed in these regions, we may conclude that the period, at which the bones of these extinct species were introduced into the cave at Kirkdale was before the deluge.

Thus the phenomena of this cave seems referable to a period immediately antecedent to the general deluge, and in which the world was inhabited by land animals, almost all bearing a generic, and many a specific resemblance to those which now exist; but so completely has the violence of that tremendous convulsion destroyed and remodelled the form of the antediluvian surface, that it is only in caverns that have been protected from its ravages, that we may hope to find undisturbed evidence of events in the period immediately preceding it. The bones already described, and the calcareous matter formed bebefore the introduction of the diluvial mud, are what Dr. Buckland considers to be the products of the period in question. It was indeed probable, before the discovery of this cave, from the abundance in which the remains of similar species occur in superficial gravel beds, which cannot be referred to any other than a diluvial origin, that such animals were the antediluvian inhabitants not only of this country, but generally of all those northern latitudes in which their remains are found (but the proof was imperfect, as it was possible they might have been drifted or floated hither by the waters from the warmer regions of the earth), but the facts developed in this charnel-house of the antediluvian forests of Yorkshire, demonstrate that there was a long succession of years, in which the elephant, rhinoceros, and hippopotamus, had been the prey of the hyænas, which, like themselves, inhabited England in the period immediately preceding the formation of the diluvial gravel. Having thus far described the principal facts to be observed in the interior of this cave, Dr. Buckland proceeds to point out the chronological inferences that may be derived from the state of the bones, and of the mud and stalagmite that accompany them, and to extract the following detail of events that have been going on successively within this curious cave: —

First, There appears to have been a period (and, if we may form an estimate from the small quantity of stalagmite now found on the actual floor of the cave, a very short one), during which this aperture in the rock existed in its present state, but was not tenanted by the hyænas.

The second period was that during which the cave was inhabited by the hyænas, and the stalactyte and stalagmyte were still forming.

The third period is that at which the mud was introduced and the animals extirpated, viz. the period of the deluge. It has been already stated, that there is not any alternation of this mud with beds of bone or of stalagmite, such as would have occurred had it been produced by land floods often repeated; *once, and once only*, it appears to have been introduced; and we may consider its vehicle to have been the turbid waters of the same inundation that produced universally the diluvial gravel.

The fourth period is that during which the stalagmite was deposited which invests the upper surface of the mud.

We have attempted, in this note, to give a slight sketch of the history of this curious cavern, and of the important inferences to be deduced from its phenomena; rather with the hope of inducing the reader to peruse the interesting volume of Dr. Buckland, from which these extracts have been made, than of affording a full and satisfactory account of a discovery which has, at once, redeemed geology from the charge of fabricating theories inconsistent with divine revelation.

NOTE 14. p. 224.

Rifle guns are those whose barrels, instead of being smooth on the inside, like our common pieces, are formed with a number of spiral channels, resembling screws;

except only that the threads, or rifles, are less deflected, making only one turn, or a little more, in the whole length of the piece. This construction is employed for correcting the irregularity in the flight of balls, from smooth barrels, by imparting to the balls a rotatory motion perpendicular to the line of direction. The same effect has lately been accomplished by an extremely simple and obvious contrivance, and which will, probably, altogether supersede the necessity of rifling the barrel. It consists in cutting a spiral groove in the bullet itself, which, when discharged, is thus acted upon by the air, and the same rotatory motion imparted to it as that produced by the furrows in the barrel. But it is the rotatory motion which steadies the flight of the ball; and by whichever method this is produced, the theory of its action will be the same. It has been long and generally known, that when the common bullet is discharged from a plane barrel, its flight is extremely irregular and uncertain; it has, for instance, been found, from the experiments of Mr. Robins, that notwithstanding the piece was firmly fixed, and fired with the same weight of powder, the ball was sometimes deflected to the right, sometimes to the left, sometimes above, and at others below the true line of direction. It has also been observed, that the degree of deflection increases in a much greater proportion than the distance of the object fired at. It is not difficult to account for these irregularities; they, doubtless, proceed from the impossibility of fitting a ball so accurately to any plain piece, but that it will rub more against one side of the barrel than another, in its passage through it. Whatever side, therefore, of the muzzle, the ball is last in contact with, on quitting the piece, it will acquire a whirling motion towards that side, and will be found to bend the line of its flight in the same direction, whether it be upwards or downwards, to the right or left; or obliquely, partaking, in some degree, of both; and after quitting the barrel, this deflection, which, though in the first instance, it is but trifling and inconsiderable, is still farther increased by the resistance of the air; this being greatest on that side where the whirling motion conspires with the progressive one, and least on that side where it is opposed to it. Thus, if the ball, in its passage out, rubs against the left side of the barrel, it will whirl towards that side; and as the right side of the ball will, therefore, turn up against the air during its flight, the resistance of the air will become greatest on the right side, and the ball be forced away to the left, which was the direction it whirled in. It happens, moreover, from various accidental circumstances, that the axis of the ball's rotation frequently changes its position several times during the flight; so that the ball, instead of bending its course uniformly in the same direction, often describes a track variously contorted. From this view of the causes of aberration in the flight of balls, it will be evident, that the only means of correcting it is by preventing the ball from rubbing more against one side of the barrel than another in passing through it; and by giving to the bullet a motion which will counteract every accidental one, and preserve its direction, by making the resistance of the air upon the forepart continue the same during its whole flight; that is, by giving it a rotatory motion perpendicular to the line of direction. The contrivance for this purpose is called *rifling*, and consists, as we have above stated, in forming upon the inside of the barrel a number of threads and furrows, either in a straight or spiral direction, into which the ball is moulded; and hence, when the gun is fired, the indented zone of the bullet follows the sweep of the rifle, and thereby, besides its progressive motion, acquires a considerable one round the axis of the barrel, which motion will be continued to the bullet after its separation from the piece, so that it is constantly made to whirl round an axis coincident with the line of its flight.

Note 15. p. 246.

Those who have been in the habit of inspecting the works of the statuary, must frequently have detected the art which he has displayed in imparting stability to his figures, by lowering their centre of gravity. The bronze figure of Achilles, in Hyde Park, affords a very striking illustration of such ingenuity; it is evident, from the position and height of the figure, that, had not a mass of matter been added to its base, in the form of armour, its stability would have been extremely precarious, since the slightest movement might have thrown its line of direction beyond the base; but the addition of the armour renders such an accident impossible, by lowering its centre of gravity. Other examples of similar contrivance are presented in several celebrated statues, wherein stability is ensured by the judicious distribution of the draperies.

Note 15. p. 273.

It has been stated in the text, that the gyrations of the top depend exactly upon the same principle as that which produces the *precession of the equinoxes;* viz., an unequal attractive force exerted upon the revolving mass. In the one case, this is known to arise from the action of the sun and moon on the excess of matter about the equatorial regions of the earth; in the other, from the parts of the top being unequally affected by gravity, while it is spinning in an inclined or oblique position. To those philosophers who have condescended to read the present work, if there be any such, and are thereby induced to pursue the investigation of a subject which has hitherto excited far too little attention, we beg to submit the following remarks:—

If a top could be made to revolve on a point without friction, and in a vacuum, in the case of its velocity being *infinite,* it would continue to revolve for ever, in the same position, without gyration. If the velocity were *finite,* it would for ever remain unchanged in position, in the event of the centre of gravity being directly over the point of rotation. In any other position (supposing its velocity very great, although not infinite) there would arise a continued uniform gyration. The line which passes through the point of rotation, and the centre of gravity, always making the same angle with the horizon, or describing the same circle round the zenith. But in all artificial experiments the circumstances are very remarkably changed; if, indeed, the centre of gravity happens to be situated perpendicularly over the point of rotation, the top will continue quite steady, or *sleeping,* as it is termed, till nearly the whole of its velocity of rotation is expended. In any other position the top begins to gyrate, but reclining at all times on the outside of its physical point of gyration, the top is uniformly impelled inwards, and this (when the velocity is considerable, and the point broad) acts with a force sufficient for carrying the top towards its quiescent or *sleeping* point; but when the velocity is much diminished, this power becomes feeble, the gyrations increase in diameter, and the top ultimately falls.

NOTE 16. p. 310.

A *cycloid* is a peculiar curve line; and is described by any one point of a circle as it rolls along a plane, and turns round its centre; thus, for instance, the nail on the felly of a cart-wheel traces a cycloid in the air as the wheel proceeds. This curve is distinguished by some remarkable properties, the most important of which is, that any body moving in such a curve, by its own weight, or swing, will pass through all distances of it in exactly the same time; and it is for such a reason that pendulums are made to swing in cyloids, in order that they may move in equal times, whether they go through a long or a short part of the same curve. Where the arc described is small, a portion of the circle will be sufficiently accurate, because it will be seen that such an arc will not deviate much from an equal portion of a cycloidal curve. The cycloid is remarkable as being that path, with the exception of the perpendicular, through which a body will move with the greatest velocity; suppose, for example, a body is to descend from any one point to any other, by means of some force acting on it, together with its weight; a person unacquainted with mechanics would say at once, that a straight line is the path it must take to effect this in the shortest possible time, since that is the shortest of all lines that can be drawn between two points. Undoubtedly it is the shortest; notwithstanding which, however, the body would be longer in traversing it, than in moving through a cycloid. If a body were to move through a space of fifty or a hundred yards, by its weight and some other force acting together, the way it must take to do this in the shortest possible time, is by moving in a cycloid. It is supposed that birds which build in the rocks possess an instinctive knowledge of this fact, and drop or fly down from height to height in this course. There is certainly a general resemblance between the curved path they describe on such occasions, and the cycloid, but it would be difficult to establish the fact by experiment.

NOTE 17. p. 313.

Karn-breh hill rises a little to the south-west of Redruth in Cornwall, to an elevation of 697 feet. Its principal interest is derived from the speculations of the antiquary, Doctor Borlase, who regarded it as having been once the grand centre of druidical worship; and he asserts, in his Antiquities of Cornwall, that, at this very time, the remains of those monuments which were peculiar to that priesthood may be discovered, such as, *rock-basins*, *circles*, *rock-idols*, *cromlechs*, *karns*, *caves*, *religious enclosures*, *logan stones*, *a gorseddau*, or place of elevation, whence the druids pronounced their decrees, and the traces of a *grove of oaks*. This is all very ingenious and imposing, and may be easily believed by those who have either not visited the spot, or, having visited it, not viewed the objects with geological eyes. There is no ground whatever for considering the druidical monuments of Dr. Borlase as the works of man; on the contrary, they are evidently the results of the operation of time and the elements, the usual agents employed by nature in the decomposition of mountain masses: but the age of antiquarian illusion is past; the light of geological science has dispelled the phantoms created by the wizard fancy, just as the rising sun dissolves the mystic forms which the most common object assumes in twilight, when viewed through the medium of credulity and superstition. The "rock-basins" of antiquaries are rounded cavities on the surface of rocks, and are occasionally as spheroidal internally, as if they had been actually formed by a turning-lathe. It was this artificial appearance which first suggested the hypothesis concerning their origin, and induced the antiquary to regard them as pools of lustration. It may, however, be remarked, in the first place, that supposing them to have been the works of the druids, these priests must have been indefatigable artists, for there is scarcely a block of granite on which one or more of such pools are not visible, although some are, undoubtedly, much more complete and imposing than others. We shall introduce to the readers an account of these rock-basins in the words of their great defender, and we think that he will be amused with the ingenuity and confidence with which the antiquary dwells upon every appearance, and bends the facts to suit his favourite theory. "Since no author has mentioned, and attempted to explain these monuments, let us see what light and assistance their shape and structure, exposition, number, and place, considered together with the customs and known rites of antiquity may afford us in this untroden path. Of these basins there are two sorts; some have lips or channels to them, others have none; and, therefore, as those lips are manifestly the works of design, not of accident, those that have so material a difference must needs have been intended for a different use, and yet both these sorts seem to be the works of the same people, for there is a multitude of these basins which have no lips or outlets, as well as those which have, to be seen on Karn-brê hill, and elsewhere, on contiguous rocks. Their shape is not uniform; some are quite irregular, some oval, and some are exactly circular. Their openings do not converge in the top as a jar or hogshead, but rather spread and widen, as if to expose the hollow as much as possible to the skies. Some have little falls into a larger basin, which receives their tribute, and detains it, having no outlet. Other large ones intermixed with little ones have passages from one to another, and by successive falls uniting, transmit what they receive into one common basin, which has a drain to it, that serves itself and all the basins above it.

" The lips do not all point in the same direction, some tending to the south, some to the west, others to the north, and others again to the intermediate points of the compass, *by which it seems as if the makers had been determined in this particular, not by any mystical veneration for one region of the heavens more than another, but by the shape and inclination of the rock, and for the most easy and convenient outlet.*" We must here beg the reader to pause. The above remark is really too valuable to be suffered to pass without some notice. And so the absence of all design and arrangement is adduced as a proof of their artificial origin! What would Dr. Borlase have said, had all these lips been found to point in the same direction? But to proceed:

"The size of rock-basins is as different as their shape, they are formed from six feet to a few inches in diameter. Many uses may suggest themselves to the imaginations of the curious from the description of these new, and hitherto scarce-mentioned monuments; in order, therefore, to obviate some prepossessions, and prevent the mind from resting so far on groundless suppositions as may make it more difficult to embrace the truth, I shall first consider what, in all probability, *cannot* have been the design of them."

The doctor then proceeds to show that they could never have been intended for evaporating salt; nor for pounding tin ore, nor for receiving obelisks, or stone deities, nor for altars; and then suggests that they could be no other than vessels most ingeniously contrived for holding holy-water for the rites of washing and purification. "If," adds the learned antiquary, "fitness can decide the use, and where history is deficient, it is all reason that it should, we shall not long be at a loss. They are mostly placed above the reach of cattle, frequently above the inspection of man; nay, the stones which have these basins on them, do not touch the common ground, but stand on other stones.—Wherefore? but that the water might neither be really defiled by the former, nor incur the imaginary impurity, which touching the ground, according to the druid opinion, gave to every thing that was holy." We do not know what ideas the druids entertained with respect to the purity of water, but we have seen water in some of these pools, so impregnated with the excrement of sea-birds, that we must have been as thirsty as Tantalus, before we could have been induced to cool our tongues with it.

"But," adds Dr. Borlase, "there are some basins which have no lip or channel; and, therefore, as they could not contribute any of their water to the common store, they *must* have been appropriated to another use; and since these are found in the same places with the others above-mentioned which have outlets or mouths to them, they must have been subservient to the same system of superstition, though in a different method.

"These basins are sometimes found near twenty feet high from the common surface; and, therefore, being so withdrawn from vulgar eyes, so elevated from the ground, which was supposed, as I said before, to defile all, they had likely a proportionably greater degree of reverence, and their waters accounted more holy, and more efficacious."

We shall not trouble the reader with any farther quotations from this learned antiquary; except in concluding the history, after the fashion of melo-dramatists, with a splendid scene, in which, with the author's assistance, we shall bring all the performers on the stage, dressed in appropriate costume, and surrounded by all the pomp of druidical worship.

"From these basins," says Dr. Borlase, "on solemn occasions, the officiating druid, standing on an eminence, sanctified the congregation with a more than ordinarily precious lustration before he expounded to them, or prayed for them, or gave forth his decisions. This water he drank, or purified his hands in, before it touched any other vessel, and was consequently accounted more sacred than the other holy-water. To these more private basins, during the time of libation, the priest might have recourse, and be at liberty to judge by the quantity, colour, motion, and other appearances in the water, of future events, of dubious cases, without danger of contradiction from the people below. This water might serve to mix their misletoe withal, as a general antidote; for, doubtless, those who would not let it touch the ground, would not mix this their divinity (the misletoe) with common water. Oak leaves, without which the druid rites did scarce ever proceed, ritually gathered and infused, might make some very medicinal or incantorial potion. Lastly, libations of water were never to be made to their gods, but when they consisted of this purest of all water, as what was immediately come from the heavens, and partly therefore thither to be returned, before it touched any other water or any other vessel whatsoever, placed on the ground.

"As *logan*, or rocking-stones, were some of the *piæ fraudes* of the druids, the basins found on them might be used to promote the juggle; by the motion of the stone the water might be so agitated, as to delude the enquirer by a pretended miracle; might make the criminal confess; satisfy the credulous; bring forth the gold of the rich; and make the injured, rich as well as poor, acquiesce in what the druid thought proper."

Sorry are we to destroy a web which has been so ingeniously woven by its author; but the interests of truth admit not of compromise. Dr. Macculloch, in an interesting paper, published in the Transactions of the Geological Society, on the decomposition of the granite tors of Cornwall, has justly observed, that the true nature of these rock-basins may be easily traced by inspecting the rocks themselves. On examination, they will always be found to contain distinct grains of *quartz*, and fragments of the other constituent parts of the granite. A small force is sufficient to detach from the sides of these cavities additional fragments, showing that a process of decomposition is still going on under favourable circumstances. The principal of these circumstances is the presence of water, or rather the alternate action of air and water. If a drop of water can only make an effectual lodgement on a surface of this granite, a small cavity is sure to be sooner or later produced; this will insensibly enlarge as it becomes capable of holding more water; and the sides, as they continue to waste, will necessarily retain an even and rounded cavity, on account of the uniform texture of the rock. This explanation is sufficiently satisfactory; in addition to which, it may be stated, that these very basins not unfrequently occur on the perpendicular sides of rocks, as may be distinctly seen in the granite of Scilly, and in the gritstone rocks in the park of the late Sir Joseph Banks, in the parish of Ashover, in Derbyshire; a fact which at once excludes the idea of their artificial origin.

The other grotesque and whimsical appearances of rocky masses, such as *rock idols*, *logan stones*, *&c.*, are to be explained by the tendency which granite possesses of wearing more rapidly on the angles and edges than on the sides; thus, then, upon simple and philosophical principles, are such appearances to be satisfactorily accounted for, and the *phantasmagoria* of Borlase vanishes as the light penetrates the theatre so long dedicated to its exhibition.

ADDITIONAL NOTES

REFERRED TO BY THE FIGURES IN

VOLUME II.

NOTE 1. p. 3.

BEFORE we enter upon the subject to which this note more immediately refers, we are anxious to supply an important omission in the text; and it is not a little extraordinary that Mr. Twaddleton, who was so devoted to every kind of literary research, should have suffered the circumstance to which we allude to have escaped his notice. Every player at marbles well knows that there are two very different descriptions of them, distinguished by the term *taw* and *alley;* the former is dark-coloured, while the latter is valued for the purity of its whiteness. We are desirous of communicating to the reader the etymology of these terms, which we have only lately discovered; the *taw* is an abbreviation for *tawny*, a word descriptive of the colour of the marble; while *alley* is abbreviated from *alabaster*, the stone of which it is composed.

In investigating the effects produced upon bodies by collision, it is necessary to distinguish between elastic and non-elastic substances, since their motions after impact are governed by very different laws.

If two bodies, *void of elasticity*, move in one right line, either the same or contrary ways, so that one body may strike directly against another, let the *sum* of their motions before the stroke, if they move the same way, and the *difference* of their motions, if contrary ways, be divided into two such parts as are proportional to the quantities of matter in the bodies, and each of those parts will respectively exhibit the motion of each body after the stroke: for example, if the quantities of matter in the bodies be as *two* to *one*, and their motions before the stroke as *five* and *four*, then the sum of their motions is *nine*, and the difference is *one*; and therefore, when they move the same way, the motion of that body, which is as *two*, will, after the stroke, be *six*, and the motion of the other, *three*; but, if they move in contrary directions, the motion of the greater body after the stroke will be *two thirds of one*, and of the lesser body *one third of one*; for, since the bodies are void of elasticity, they will not separate after the stroke, but move together with one and the same velocity; and, consequently, their motions will be proportional to their quantities of matter; and it follows from the fact of action and reaction being equal, that no motion is either lost or gained by the stroke when the bodies move the same way; because, whatever motion one body imparts to the other, so much must it lose of its own; and, consequently, the *sum* of their motions before the stroke is neither increased nor diminished by the stroke, but is so divided between the bodies, as that they may move together with one common velocity; that is, it is divided between the bodies in proportion to their quantities of matter: but it is otherwise, where the bodies move in opposite directions, or contrary ways, for then the smaller motion will be destroyed by the stroke, as also an equal quantity of the greater motion, because action and reaction are equal; and the bodies, after the stroke, will move together equally swift, with the *difference* only of their motions before the stroke; consequently, that difference is, by means of the stroke, divided between them in proportion to their quantities of matter.

The several particular cases, concerning the collision of bodies, may be reduced to four general ones; viz.

1st. It may be, that one body only is in motion at the time of the stroke.

2d. They may both move one and the same way.

3d. They may move in direct opposition to each other, and that with equal quantities of motion.

4th. They may be carried with unequal motions in directions contrary to each other.

As the bodies may be either equal or unequal, each of these four general cases may be considered as consisting of two branches.

As to the first, if a body in motion strikes another equal body at rest, they will, according to the proposition, move together each of them with one half of the motion that the body had which was in motion before the stroke; and since the quantity of motion in any body is as the product arising from the multiplication of its quantity of matter into its velocity, the common velocity of the two bodies will be but one half of the velocity of the moving body before the stroke.

As to the second general case, where both the bodies are in motion before the stroke, and move one and the same way. In order to find their common velocity after impact, let the sum of their motions before the stroke be divided by the sum of the bodies, and the quotient will express the common velocity.

As to the third general case, where the bodies move in direct opposition to each other, if they have equal quantities of motion, they will upon the stroke lose all their motion, and continue at rest; for, by the proposition, the bodies after impact will be carried with the difference of their motions before the stroke; which difference, in such a case, is nothing.

When two bodies meet with unequal quantities of motion, if the difference of their motions be divided by the sum of the bodies, the quotient will express their common velocity after the stroke; for, by the proposition, the difference of their motions before the stroke is equal to the sum of their motions after the stroke; consequently, that difference divided by the sum of the bodies must give the velocity.

Such are the principal laws which govern the collision of bodies devoid of elasticity. The motions of elastic bodies are determined by different rules; for when they are perfectly elastic the velocity gained by the body struck, and the velocity lost by the striking body, will be twice as great as if the bodies were perfectly inelastic. In estimating, therefore, the motions of such bodies, we may first consider what they would have been, after impact, had they been inelastic, and thence deduce the desired conclusion. See Helsham's Lectures, a work in which the subject appears to be very clearly treated.

NOTE 2. p. 32.

We are indebted to Sir Everard Home for a description of that peculiar structure, by which several species of animals are enabled to sustain their bodies in opposition to the force of gravity. His first paper upon this subject is published in the 106th volume of the Philosophical Transactions, in which he says, he was not aware that any animal, larger than the house-fly, was endowed by nature with such a power, so as to admit of examination, until Sir Joseph Banks mentioned that the *lacerta gecko*, a species of lizard, which is a native of the island of Java, comes out of an evening from the roofs of the houses, and walks down the smooth, hard, and polished chinam walls, in search of the flies which settle upon them, and which are its natural food, and then runs up again to the roof of the house. Sir Joseph, while at Batavia, amused himself with catching this animal, by standing close to the wall, at some distance from the lizard, with a long flattened pole, which being made suddenly to scrape the surface of the wall, knocked the animal down. He presented Sir Everard with a specimen weighing five ounces and three quarters, avoirdupois, which enabled him to ascertain the peculiar mechanism by which the feet of this animal can keep their hold of a smooth, hard, perpendicular wall, and carry up so large a weight as that of its body.

The foot has five toes, at the end of each of which, except that of the thumb, is a very sharp and much curved claw; on the under surface of each toe are sixteen transverse slits, leading to so many cavities or pockets, the depth of which is nearly equal to the length of the slit that forms the orifice; they all open forwards, and the external edge of each opening is serrated, like the teeth of a small-toothed comb. The cavities, or pockets, are lined with a cuticle, and the serrated edges are also covered with it. The structure just described is supplied with various muscles whose action is to draw down the claw, open the orifices of the pockets, and turn down the serrated edges upon the surface on which the animal stands. Upon examining attentively the under surfaces of the toes, when the pockets are closed, Sir Everard Home was struck with their resemblance to the surface of that portion of the *echineis remora*, or sucking fish, by which it attaches itself to the shark, or to the bottom of ships; and it consequently suggested the probability of obtaining, from an examination of this latter apparatus, much useful information which might be applicable to the subject of the lizard; more especially as the parts of which it is composed are so much larger in size, and more within the reach of anatomical examination.

The surface on the top of the head of this fish, fitted for adhesion, is of an oval form, and bears a considerable proportion to the size of the whole animal; it is surrounded by a broad, loose, movable edge, capable of applying itself closely to the surface on which it is placed; and it is evident that when the external edge is so applied, and the cartilaginous plates are raised up, the interstices must become so many vacua, and the serrated edge of each plate will keep a sufficient hold of the substance on which it rests to retain it in that position, assisted by the pressure of the surrounding water, without a continuance of muscular exertion. It thus appears that the adhesion of the *sucking fish* is produced by so many vacua being formed through an apparatus worked by the voluntary muscles of the animal, and the pressure of the surrounding water.

From the similarity of the mechanism of the under surface of the toes of the *lacerta gecko*, there can be no doubt that the purpose to which it is applied is the same: but as in the one case the adhesion is to take place under water, and is to continue for longer periods, the means are more simple; in the other, where the mechanism is to be employed in air, under greater disadvantages with respect to gravity, and is to last for very short periods, and then immediately afterwards be renewed, a more delicate structure of parts, a greater proportional depth of cavities, and more complex muscular structure become necessary.

Having ascertained the principle on which an animal of so large a size as the *lacerta gecko* is enabled to support itself in its progressive motion against gravity, Sir E. Home felt himself more competent to enquire into the mechanism by which the common fly is enabled, with so much facility, to support itself in still more disadvantageous situations. In the natural size, the feet of the fly are so small, that nothing can be determined respecting them; Keller was the first person who made a drawing of the fly's foot in a highly magnified state, in which the concave surfaces are visible, and which, no doubt, like those of the lizard above described, are employed to form vacua, which enable the fly to move under such disadvantageous circumstances. Mr. Bauer, who has so greatly distinguished himself in microscopic researches, was judiciously enlisted into the service of Sir E. Home upon this occasion; and he has shown that this principle, on which progressive motion against gravity depends, is very extensively employed by nature in the structure of the feet of insects; and Sir Everard observes, that now this structure is known, it can be readily demonstrated by looking at the movement of the feet of any insect upon the inside of a glass tumbler, through a common magnifying glass; the different suckers are readily seen separately to be pulled off from the surface of the glass, and reapplied to another part.

In consequence of the expedition to the polar regions, Sir E. Home was enabled to obtain and examine the foot of the walrus, in which he detected a resemblance in structure to that of the fly; and it is not a little curious that two animals so different in size should have feet so similar in their use. In the fly, the parts require to be magnified one hundred times to render the structure distinctly visible; and in the walrus the parts are so large, as to require being reduced four diameters, to bring them within the size of a quarto page.

Nor is progressive motion, the only function in which nature avails herself of the pressure of the atmosphere for the accomplishment of her purposes. The act of feeding is continually effected in this manner. The operation of sucking is too familiar to require comment. It may not, perhaps, be so generally known that it is by the very same process that bees reach the fine dust and juices of hollow flowers, like the honeysuckle, and some species of foxglove, which are too narrow to admit them. They fill up the mouth of the flower with their bodies, and suck out the air, or at least a large portion of it, by which the soft sides of the flower are made to collapse, and the juice and dust are squeezed towards the insect, as completely as if the hand had pressed it externally.

NOTE 3. p. 41.

Those who are not acquainted with the operations by which the mind is enabled to arrive at truth, are too apt to attribute to accident that which is the result of great intellectual labour and acuteness. Observation, analogy, and experiment are the three great stepping-stones by which the philosopher is enabled to ascend from darkness to light: it is true that his foot may accidentally be placed upon the first, but his own efforts are required to complete the ascent. To the mass of mankind the preliminary step is obvious, and they, at once, conclude that the succeeding ones are equally easy and simple. In this view of the subject, it was by accident that Sir Isaac Newton discovered the laws of gravitation, for his mind was directed to the investigation by the accidental fall of an apple from its tree; it was by accident that Galileo discovered the isochronous movement of the pendulum, for it was suggested by the vibration of a chandelier: but how many persons might have witnessed the fall of an apple, or the vibration of a chandelier, without arriving at similar truths? It has been said that we are indebted for the important invention in the steam-engine, termed *hand geer*, by which its valves or cocks are worked by the machine itself, to an idle boy of the name of Humphrey Potter, who, being employed to stop and open a valve, saw that he could save himself the trouble of attending and watching it, by fixing a plug upon a part of the machine which came to the place at the proper times, in consequence of the general movement. If this anecdote be true, what does it prove? That Humphrey Potter might be very idle, but that he was, at the same time, very ingenious. It was a contrivance, not the result of accident, but of acute observation and successful experiment. We are endeavouring to combat a popular but mischievous error; and we are happy at finding the same feeling expressed in a work which, from its extensive circulation, must prove highly useful in correcting it. "Very few discoveries," says the author, "have been made by chance and by ignorant persons; much fewer than is generally supposed. They are generally made by persons of competent knowledge, and who are in search of them. The improvement of the steam-engine by Watt, resulted from the most learned investigation of mathematical, mechanical, and chemical truths. Arkwright devoted many years, five at least, to his invention of spinning-jennies. The new process of refining sugar, by which more money has been made in a shorter time, and with less risk and trouble, than was perhaps ever gained by an invention, was discovered by Mr. Howard, a most accomplished chemist, and it was the fruit of a long course of experiments, in the progress of which, known philosophical principles were constantly applied, and one or two new principles ascertained."—*Library of Useful Knowledge*.

NOTE 4. p. 58.

If a soap-bubble be blown up, and set under a glass, that the motion of the air may not affect it, as the water glides down the sides and the top grows thinner, several colours will successively appear at the top, and spread themselves from thence in rings down the sides of the bubble, till they vanish in the same order in which they appeared; at last a black spot appears at the top, and spreads till the bubble bursts. Hence it follows that the colours of a body, depend in some degree upon the thickness and density of the particles that compose them; and that if the density be changed the colour will likewise be changed. That the production of colours depends upon the nature of the surfaces upon which light falls, is beautifully exemplified by the iridescence of mother of pearl; and which has been satisfactorily shown to depend upon a singular peculiarity in the structure of that substance. On its surface, which to the unassisted eye, and even to the touch, appears to be finely polished, there are innumerable little lines, or *grooves*, in some places as many as two or three thousand in the space of an inch, which, lying parallel, regularly follow each other in all their windings; by the edges of which the rays of light are reflected, and the continual change of colour arises from their continual bendings. Whatever doubts might have existed upon the subject, some late experiments of Dr. Brewster have dissipated them, by showing that the colours which play so beautifully on the surface of mother of pearl, may be communicated by pressure to sealing-wax and several other substances. The discovery of this fact was in some measure accidental; he had stuck a piece of mother of pearl on a cement made of rosin and bees-wax, and on separating this cement he found that it had acquired the property of exhibiting colours. Several persons who witnessed the effect, concluded that it arose from the presence of a thin film of the mother of pearl, which might have scaled off and adhered to the wax: but such an explanation was at once refuted, by plunging the wax in acid, which must have dissolved the mother of pearl, had any been present; but the acid had no effect, and the colours of the impression remained unimpaired. It is clear, then, that it is the grooves, as Dr. Brewster conjectured, which occasion the iridescence in the mother of pearl, as well as in the waxen impression. In consequence of this curious discovery, Mr. Barton succeeded in producing the same appearance on glass, and on different metals, by simply cutting grooved lines on their surface. These lines are so fine that, without a microscope, they are scarcely visible, and the glass and the metal appear to retain their polish; yet they and the colours also may be communicated by an impression, like those from the mother of pearl, to the wax.

Note 6. p. 90.

The following are a few of those plants which indicate changes in the weather: —

Chickweed is an excellent barometer. When the flower expands fully, we are not to expect rain for several hours; should it continue in that state, no rain will disturb the summer's day. When it half conceals its miniature flower, the day is generally showery; but, if it entirely shuts up, or veils the white flower with its green mantle, let the traveller put on his great coat. The different species of *trefoil* always contract their leaves at the approach of a storm; so certainly does this take place, that these plants have acquired the name of the *husbandman's barometer.* The tulip and several of the compound yellow flowers also close before rain. There is, besides, a species of wood-sorrel, which doubles its leaves before storms and tempests. The *bauhinia*, or mountain ebony, *cassia*, and sensitive plants, observe the same habit.

Note 7. p. 92.

The popular adage of *Forty days' rain after St. Swithin*, is a tradition which seems to have derived its origin from the following circumstance. Swithin, or *Swithum*, bishop of Winchester, who died in 868, desired that he might be buried in the open church-yard, and not in the chancel of the minster, as was usual with other bishops; and his request was complied with: but the monks, on his being canonized, considering it disgraceful for the saint to lie in a public cemetery, resolved to remove the body into the choir, which was to have been done with solemn procession on the 15th of July. It rained, however, so violently for forty days together at this season, that the design was abandoned. "Now, without entering into the case of the bishop," says Mr. Howard, in his work on the Climate of London, "who was probably a man of sense, and wished to set the example of a more wholesome, as well as a more humble, mode of resigning the perishable clay to the destructive elements, I may observe, that the fact of the hindrance of the ceremony by the cause related is sufficiently authenticated by tradition; and the tradition is so far valuable, as it proves that the summers in this southern part of our island, were subject, a thousand years ago, to occasional heavy rains, in the same way as at present." Mr. Howard has shown, by a table, that the notion commonly entertained on this subject, if put strictly to the test of experience, at any one station, in this part of the island, will be found fallacious; he, however, very justly observes, that "the opinion of the people on subjects connected with Natural History is commonly founded, in some degree, on fact or experience;" and to do justice to the popular observation in question, he states that, "in a majority of our summers, a showery period, which, with some latitude as to time and local circumstances, may be admitted to constitute daily rain for forty days, does come on about the time indicated by this tradition; not that any long space before is often so dry as to mark distinctly its commencement."

NOTE 8. p. 110.

This fact may be demonstrated by converting the triangle into a parallelogram, of which one of the sides of the triangle will become its diagonal; the other two sides will, of course, represent two forces equivalent to such diagonal, which, acting in opposition to it, must produce a balance.

NOTE 9. p. 122.

The sea and land breezes which occur in the islands of the torrid zone, very strikingly illustrate the position laid down in the text, and afford a good explanation of the manner in which winds may be occasioned by a change of temperature in the air. In these, during the hottest part of the day, the wind sets in from all quarters, and appears to be blowing towards the centre of the island, while in the night it changes its direction, and blows from the centre of the land towards the sea; for since the sun's rays produce much more heat by their reflection from land than they do from water, that portion of air which is over the land will soon become heated, and will ascend; a rarefaction and diminution of the quantity of air over the central part of the land will be thus occasioned, which must be supplied from the sides; but, as the land cools again during the night, that portion of air which had been previously heaped up will begin to descend, and by spreading and equalizing itself will produce a breeze blowing from the centre.

The *trade-winds*, so called from the advantage which their certainty affords to trading vessels, are another example of the same kind; they are generally stated to blow from east to west over the equator, and are occasioned by the rarefaction of the air by the sun's heat, and the motion of the earth from west to east. While writing the present note, we have seen an essay upon the subject by Captain Basil Hall, published in an appendix to Mr. Daniel's admirable work on Meteorology; the perusal of this paper has induced us to cancel what we had written, and to refer the reader to the essay itself; for it is quite impossible to do justice to the views it entertains, in the limited space necessarily prescribed to us in this note.

On the coast of Guinea, the wind always sets in upon the land, blowing westerly instead of easterly; this exception arises from the deserts of Africa, which lie near the equator, and being a very sandy soil reflect a great degree of heat into the air above them, which being thus rendered lighter than that which is over the sea, the wind continually rushes in upon the land to restore the equilibrium.

Among the irregular winds, or those which are not constant, but accidental, may be noticed the *whirlwind*, the *harmattan*, and the *sirocco*. The first of these is occasioned by the meeting of two or more currents of wind from opposite directions, and which can only be occasioned by some temporary but violent disturbance of equilibrium. The *harmattan* is met with on the western coast of Africa, and is generally attended by great heat and fog; it appears to be occasioned by a conflict between the heated sands of Africa, and the regular direction of the trade-winds over that continent, and by disturbing their progress, it is frequently the forerunner of a hurricane in the West Indies. The *sirocco* occurs in Egypt, the Mediterranean, and in Greece, and is chiefly characterised by its unhealthy qualities. The air, by passing over the heated sands of Egypt becomes so dried and rarefied as to be scarcely fit for respiration, and being so prepared, it absorbs so much humidity on passing the Mediterranean as to form a suffocating and oppressive kind of fog.

Mr. Daniel observes, that the currents of a heated room, in some measure, exemplify the great currents of the atmosphere. If the door be opened, the flame of a candle held to the upper part will show, by its inclination, a current flowing outwards; but, if held near the floor, it will be directed inwards. If the door be closed suddenly from without, it moves with the in-coming current, and against the out-going, and a condensation of air takes place in the room, which is proved by the rattling of the windows, and the bursting open of any other door in the room, if slightly closed. If the door close from within, it moves against the in-coming current, and with the out-going, and a rarefaction of the air in the room takes place, which is evidenced by the rattling of the windows, and the bursting open of another door in the contrary direction.

NOTE 10. p. 30

We are reminded, upon this occasion, of part of a stanza in the well-known ballad of Chevy Chace, where an English archer aimed his arrow at Sir Hugh Montgomery: —

> " The *grey goose wing* that was thereon,
> In his hearte's blood was wett."

The more ancient ballad, however, reads *swane-feathers*. In the " Geste of Robyn Hode," among Mr. Garrick's old plays, in the Museum, the arrows of the outlaw and his companions are particularly described: —

> " With them they had an hundred bowes,
> The strings were well ydight;
> An hundred shefe of arrows good,
> With hedes burnish'd full bryght;
> And every arrowe an ell longe,
> With *peacocke* well ydight,
> And rocked they were with white silk,
> It was a semely sight."

And Chaucer, in the description of the squyer's yeoman says: —

> " And he was clad in cote and hode of greene;
> A sheafe of *peacocke* arrows bryght and shene,
> Under his belt he bare full thriftely,
> Well coude he dresse his tackle yemanly:

His arrowes drouped not with fethers lowe,
And in his hand he bare a mighty bowe."

Prol. to Cant. Tales.

In order to show the *dandyism* displayed by the archers of former times, it may be stated, that, in the wardrobe accounts of the 28 Edw. I. p. 359. is a charge of verdigrise to stain the feathers of the arrows green. A wardrobe account of the 4 Edw. II. furnishes an entry for peacock arrows, "Pro duodecim flecchiis cum pennis de *pavone*, emptis pro rege de 12 den."

As this note has some connection with the shuttlecock, as well as the arrow, we may take this opportunity of introducing a passage, which was accidentally omitted in the text; it refers to the method of playing this game at Turon, in Cochin China; and which is described by a traveller as follows: — "Instead of using a battledoor, as is the custom in England, the players stood seven or eight in a circle; and, after running a short race, and springing from the floor, they met the descending shuttlecock with the sole of the foot, and drove it up again with force high in the air. The game was kept up with much animation, and seldom did the players miss their stroke, or give it a wrong direction. The shuttlecock was made of a piece of dried skin rolled round, and bound with strings. Into this skin were inserted three feathers, spreading out at top, but so near to each other, where they were stuck into the skin, as to pass through the holes, little more than a quarter of an inch square, which were always made in the centre of Cochin copper coins. We made one or two awkward attempts at the game, not only to our own confusion, but much to the amusement of the natives. It must, however, be remembered, that, amongst these ingenious people, the feet assist, as auxiliaries to the hands, in the exercise of many trades, particularly that of boat building."

NOTE 11. p. 165.

A beautiful experiment was lately instituted at Paris, to illustrate this fact, by Biot. At the extremity of a cylindrical tube, upwards of 3000 feet in length, a ring of metal was placed, of the same diameter as the aperture of the tube; and in the centre of this ring, in the mouth of the tube, was suspended a clock bell and hammer. The hammer was made to strike the ring and the bell at the same instant, so that the sound of the ring would be transmitted to the remote end of the tube through the conducting power of the matter of the tube itself; while the sound of the bell would be transmitted through the medium of the air included within the tube. The ear being then placed at the remote end of the tube, the sound of the ring, transmitted by the metal of the tube, was first distinctly heard; and, after a short interval had elapsed, the sound of the bell, transmitted by the air in the tube, was heard. The result of several experiments was, that the metal of the tube conducted the sound with about ten and a half times the velocity with which it was conducted by the air; that is, at the rate of about 11,865 feet per second.

Note 12. p. 205.

The Memoirs of Madame de Genlis first made known the astonishing powers of a poor German soldier on the Jew's harp. This musician was in the service of Frederick the Great, and finding himself one night on duty under the windows of the king, played the Jew's harp with so much skill, that Frederick, who was a great amateur of music, thought he heard a distinct orchestra. Surprised on learning that such an effect could be produced by a single man with two Jew's harps, he ordered him into his presence; the soldier refused, alleging, that he could only be relieved by his colonel; and that, if he obeyed, the king would punish him the next day, for having failed to do his duty. Being presented the following morning to Frederick, he was heard with admiration, and received his discharge and fifty dollars. This artist, whose name Madame de Genlis does not mention, is called Koch; he has not any knowledge of music, but owes his success entirely to a natural taste. He has made his fortune by travelling about, and performing in public and private, and is now living retired at Vienna, at the advanced age of more than eighty years. He used two Jew's harps at once, in the same manner as the peasants of the Tyrol, and produced, without doubt, the harmony of two notes struck at the same moment, which was considered by the musically-curious as somewhat extraordinary, when the limited powers of the instrument were remembered. It was Koch's custom to require that all the lights should be extinguished, in order that the illusion produced by his playing might be increased.

It was reserved, however, for Mr. Eulenstein to acquire a musical reputation from the Jew's harp. After ten years of close application and study, this young artist has attained a perfect mastery over this untractable instrument. In giving some account of the Jew's harp, considered as a medium for musical sounds, we shall only present the result of his discoveries. This little instrument, taken singly, gives whatever grave sound you may wish to produce, as a *third*, a *fifth*, or an *octave*. If the grave tonic is not heard in the bass Jew's harp, it must be attributed, not to the defectiveness of the instrument, but to the player. In examining this result, you cannot help remarking the order and unity established by nature in harmonical bodies, which places music in the rank of exact sciences. The Jew's harp has three different tones; the bass tones of the first octave bear some resemblance to those of the flute and clarionet; those of the middle and high, to the *vox humana* of some organs; lastly, the harmonical sounds are exactly like those of the *harmonica*. It is conceived that this diversity of tones affords already a great variety in the execution, which is always looked upon as being feeble and trifling, on account of the smallness of the instrument. It was not thought possible to derive much pleasure from any attempt which could be made to conquer the difficulties of so limited an instrument; because, in the extent of these octaves, there were a number of spaces which could not be filled up by the talent of the player; besides, the most simple modulation became impossible. Mr. Eulenstein has remedied that inconvenience, by joining sixteen Jew's harps, which he tunes by placing smaller or greater quantities of sealing-wax at the extremity of the tongue. Each harp then sounds one of the notes of the gamut, diatonic or chromatic, and the performer can fill all the intervals, and pass all the tones, by changing the harp. That these mutations may not interrupt the measure, one harp must always be kept in advance, in the same manner as a good reader advances the eye, not upon the word which he pronounces, but upon that which follows.

NOTE 13. p. 227.

This project has lately been revived; in a late number of the *Revue Encyclopédique* there is a proposal to communicate verbal intelligence, in a few moments, to vast distances, and thus not by symbols, as in the Telegraph, but in distinct articulate sounds uttered by the human voice. The plan is said to have originated with an Englishman, Mr. Dick, according to whose experiments the human voice may be made intelligible at the distance of twenty-five or thirty miles. It has been stated, in Note 11., that the celebrated Biot had ascertained that sound travels more than ten times quicker when transmitted by solid bodies, or through tubes, than when it passes through the open air; at the distance of more than half a mile the low voice of a man was distinctly heard. Father Kircher relates, in some of his works, that the labourers employed in the subterranean aqueducts of Rome heard each other at the distance of several miles.

ADDITIONAL NOTES

REFERRED TO BY THE FIGURES IN

VOLUME III.

NOTE 1. p. 40.

THE *carrier* is a variety of the common domestic pigeon, and which, from the superior attachment that it shows to its native place, is employed in many countries as the most expeditious courier. The letters are tied under its wing, it is let loose, and, in a very short space, returns to the home it was brought from, with its advices. This practice was much in vogue in the East; and at Scanderoon, till of late years, it was used on the arrival of a ship, to give the merchants at Aleppo a more expeditious notice than could be done by any other means. In our own country, these aerial messengers have been employed for a very singular purpose, having been let loose at Tyburn at the moment the fatal cart was drawn away, to notify to distant friends, the departure of the unhappy criminal.

In the East, the use of these birds seems to have been greatly improved, by having, if we may use the expression, relays of them ready to spread intelligence to all parts of the country; thus it is stated by Ariosto (canto 15.) that the governor of Damiata circulated the news of the death of Orrilo. "As soon as the commandant of Damiata heard that Orrilo was dead, he let loose a pigeon, under whose wing he had tied a letter. This fled to Cairo, from whence a second was despatched to another place, as is usual; so that in a very few hours, all Egypt was acquainted with the death of Orrilo."

But the simple use of them was known in very early times. Anacreon tells us (ode ix.) that he conveyed his billet-doux to Bathyllus by a dove.

Taurosthenes also, by means of a pigeon he had decked with purple, sent advice to his father, who lived in the isle of Ægina, of his victory in the olympic games, on the very day he had obtained it.* And, at the siege of Modena, Hirtius without, and Brutus within the walls, kept, by the help of pigeons, a constant correspondence; baffling every stratagem of the besieger, Antony, to intercept their couriers. In the times of the crusades, there are many more instances of these birds of peace being employed in the service of war: Joinville relates one during the crusade of *Saint Louis*, and Tasso another, during the siege of Jerusalem. *Pennant's British Zoology.*

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* *Ælian. Var. Hist.* lib. ix. c. 2. Pliny, lib. x. c. 24. says, that swallows have been made use of for the same purpose.

NOTE 2. p. 46.

The soothsayers attributed many mystic properties to the coral; and it was believed to be capable of giving protection against the influence of *Evil Eyes;* it was even supposed that coral would drive away devils and evil spirits; hence arose the custom of wearing amulets composed of it around the neck, and of making crowns of it. Pliny and Dioscorides are very loud in the praises of the medicinal properties of this substance, and Paracelsus says that it should be worn round the necks of infants, as an admirable preservative against fits, sorcery, charms, and even against poison. It is a curious circumstance that the same superstitious belief should exist among the negroes of the West Indies, who affirm that the colour of coral is always affected by the state of health of the wearer, it becoming paler in disease. In Sicily it is also commonly worn as an amulet by persons of all ranks, as a security against an *evil eye;* a small twisted piece, somewhat resembling a horn, is worn at the watch-chain, under the name of *Buon Fortùna,* and is occasionally pointed at those who are supposed to entertain evil intention. His late Sicilian Majesty was celebrated for his faith in, and frequent use of, the *buon fortuna.* — But to return to the coral toy usually suspended around the necks of children in our own country. In addition to the supposed virtues of the coral it may be remarked that silver bells are usually attached to it, which are generally regarded as mere accompaniments to amuse the child by their jingle; but the fact is, that they have a different origin, having been designed to frighten away evil spirits. For the same superstitious objects were bells introduced into our churches, as a species of charm against storms and thunder, and the assaults of Satan.

Note 3. p. 77.

This problem is to be found in Hutton's Recreations, and is stated as follows: —

" A person having in one hand an *even* number of shillings, and in the other an *odd*, to tell in which hand he has the even number.

" Desire the person to multiply the number in the right hand by any even number whatever, and that in the left by any odd number; then bid him to add together the two products, and if the whole sum be odd, the even number of shillings will be in the right hand, and the odd number in the left; if the sum be even, the contrary will be the case. By a similar process, a person having in one hand a piece of gold and in the other a piece of silver, we can tell in which hand he holds the gold, and in which the silver. For this purpose, some value represented by an even number, such as 8, must be assigned to the gold, and a value represented by an odd number, such as 3, must be assigned to the silver; after which the operation is exactly the same as in the preceding example.

" To conceal the artifice better, it will be sufficient to ask whether the sum of the two products can be halved without a remainder; for, in that case, the total will be even, and in the contrary case odd.

"It will be readily seen that the pieces, instead of being in the two hands of the same person, may be supposed to be in the hands of two persons, one of whom has the even number, or piece of gold, and the other the odd number, or piece of silver. The same operations may then be performed in regard to these two persons, as are performed in regard to the two hands of the same person, calling the one, privately, the right, and the other the left."

NOTE 4. p. 79.

It is by discovering the number of counters left on the board that this trick is performed. By means of a table the problem may be immediately solved, but as such a reference would be inconvenient, and, indeed, destructive to the magic of the trick, a Latin verse is substituted, which may be easily carried in the memory, and will be found to answer all the purposes of a table. In order, however, that the reader may become thoroughly acquainted with the machinery of the trick, we shall explain it in the words of its author. The problem is stated as follows: "*Three things being privately distributed to three persons, to guess that which each has got.*"

Let the three things be a ring, a shilling, and a glove. Call the ring A, the shilling E, and the glove I; and in your own mind distinguish the persons by calling them first, second, and third. Then take twenty-four counters, and give one of them to the first person, two to the second, and three to the third. Place the remaining eighteen on the table, and then retire, that the three persons may distribute among themselves the three things proposed without your observing them. When the distribution has been made, desire the person who has the ring to take from the eighteen remaining counters as many as he has already; the one who has the shilling to take twice as many as he has already, and the person who has the glove to take four times as many; according to the above supposition then, the first person has taken one, the second four, and the third twelve; consequently, one counter only remains on the table. When this is done, you may return, and by the number left, can discover what thing each person has taken, by employing the following words:—

1	2	3	5	6	7
Salve	*certa*	*animæ*	*semita*	*vita*	*quies.*

To make use of these words, you must recollect, that in all cases there can remain only 1, 2, 3, 5, 6, or 7 counters, and never 4. It must likewise be observed, that each syllable contains one of the vowels, which we have made to represent the things proposed, and that the first syllable of each word must be considered as representing the first person, and the second syllable the second. This being comprehended, if there remains only one counter, you must employ the first word, or rather the two first syllables, *sal-ve,* the first of which, that containing A, shows that the first person has the ring represented by A; and the second syllable, that containing E, shows that the second person has the shilling represented by E; from which you may easily conclude that the third person has the glove. If two counters should remain, you must take the second word *cer-ta,* the first syllable of which, containing E, will show that the first person has the shilling represented by E; and the second syllable containing A, will indicate that the second person has the ring, represented by A. In general, whatever number of counters remain, that word of the verse, which is pointed out by the same number must be employed.

Instead of the above Latin verse, the following French one might be used: —

1 2 3 5 6 7
Par fer César jadis devint si grand prince.

In using the above line, it must be considered as consisting only of six words.

This problem might be proposed in a manner somewhat different, and might be applied to more than three persons. Those of our readers who may be desirous of further information on the subject, must consult Bachet in the 25th of his *Problèmes plaisantes et délectables.*

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